THE FAR EASTERN REVIEW

FOUNDED BY GEORGE BRONSON REA
36TH YEAR OF PUBLICATION

遠東時報

上海黃浦灘念四號

In This Issue

TEA LEAVES FROM LO PAT'S GARDEN

JAPAN AND MANCHOUKUO'S INDUSTRIAL DEVELOPMENT

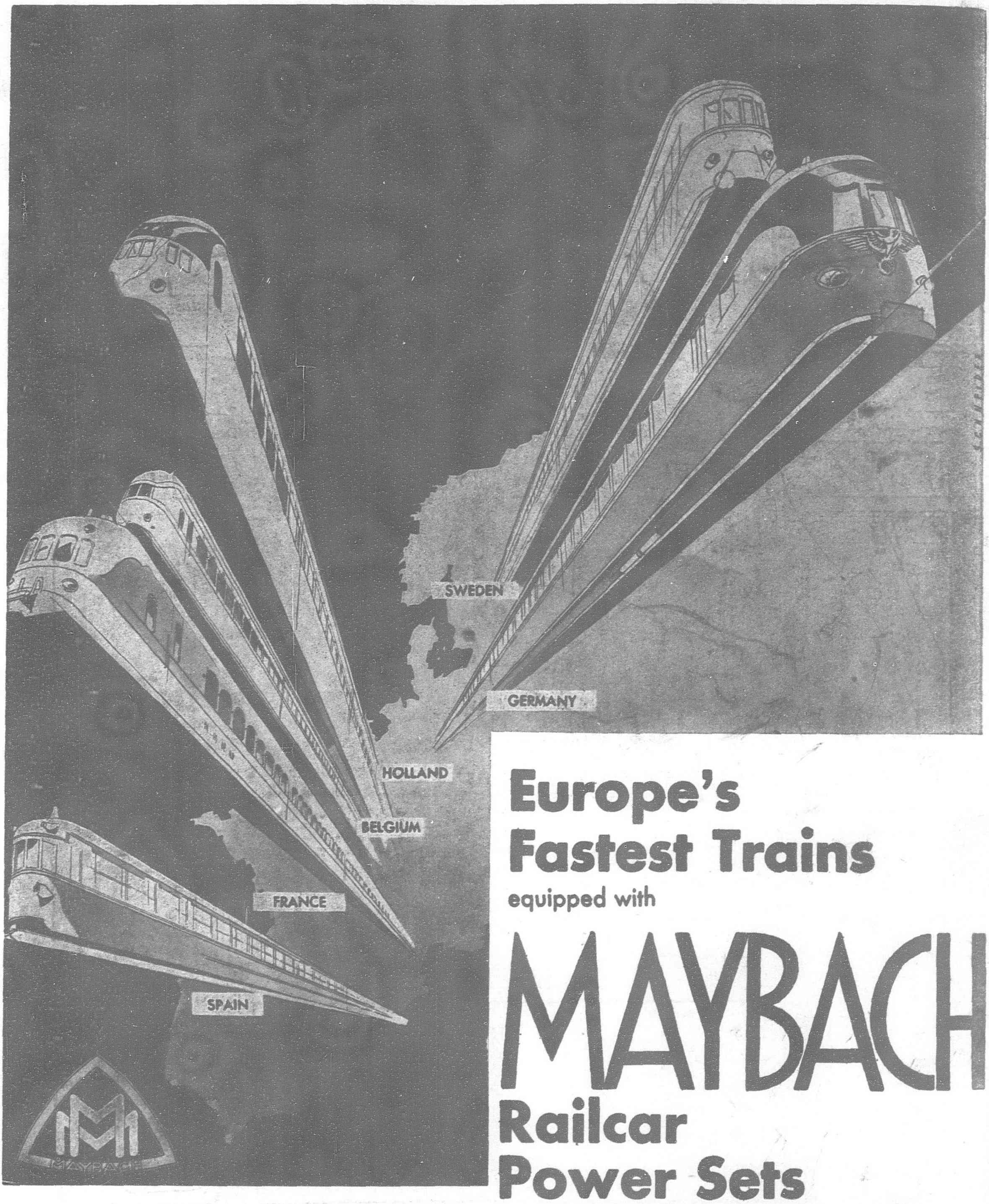
THE DUTCH EAST INDIES ADRIFT

PORTRAIT OF MR. WANG CHING-WEI

Vol. XXXVI

AUGUST, 1940

No. 8



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VOL. XXXVI SHANGHAI, AUGUST, 1940 No. 8

FAR EASTERN CROSS-CURRENTS

Complete reorganization of Japan and her Empire to mobilize the whole resources and powers of her people for national defence and the establishment of a new order in East Asia which must be made self-sufficient for a larger life devoted to the state, was avowed as the aim and basic policy of the Konoye Government in a statement issued on August 1.

Announcing the vast project had been formally approved at the joint meeting of the Imperial Headquarters and the Government, the statement stressed how the people of Japan would be re-educated to meet the needs of the hour while material mobilization would embrace not only Japan's own economic system but the whole of East Asia which would be made self-sufficient to support a more abundant life for the people devoted to a life of service to the state, towards which end a new political structure would be organized for Japan.

"The world stands at a great historic turning point," the Government statement read, "and is about to witness the creation of new forms of government, economy and culture based on the growth and development of sundry groups of states.

"Japan, too, is confronted with a great trial such as she has never experienced in her history.

"In order to carry out fully at this juncture, our national policy in accordance with the lofty spirit in which the country was founded, it is of urgent necessity for us that we should grasp the inevitable trends of developments of world history, speedily effect fundamental renovation of all branches of government and strive for perfection of the state structure for national defense.

"Accordingly the general lines of the country's fundamental national policies have been formulated as follows:

"(1) Basic policy. Japan's national policy lies in the firm establishment of world peace in accordance with the lofty spirit of 'Hakko Ichiu' ('Eight corners of the world under one roof') whereby the country was founded, and in the construction as a first step, of the new order in Greater East Asia having for its foundation complete solidarity of Japan, Manchoukuo and China. Japan will therefore develop the total strength of the nation towards the fulfilment of this policy by swiftly setting up an unshakable national structure of her own adapted to meet requirements of new developments both at home and abroad.

"(2) National defense and foreign policy. The Government will strive for the replenishment of armaments adequate for the execution of national policies by taking into consideration all new developments both at home and abroad and by constructing a state structure for national defense capable of bringing into full play the total strength of the nation. Japan's foreign policy, which aims at ultimately constructing the new order in Greater East Asia, will be directed first of all towards the complete settlement of the China Affair and the advancement of national fortune by taking far-sighted appraisal of the drastic changes in the international situation and formulating both constructive and flexible measures.

"(3) Renovation of the internal structure of Japan. What is urgently required to meet the internal situation is the laying down of the foundations for a state structure for national defense, complete renovation of domestic administration in general, for which purpose the Government expects the realization of the following points:

"(*a*) Educational reform thoroughly in harmony with the fundamental principles and polity of the nation, and also the establishment of ethical principles for the nation stressing above all, service to the state, and the eradication of all selfish and materialistic rights.

"(*b*) Establishment of a powerful political structure and unified control of government affairs, including the establishment of a new national structure the keynote of which lies in service to the state through co-operation between the government and the people, everyone according to his sphere of profession or business, renovation of the Diet as an organ for assisting the Throne and adapting the Diet to the new national structure and fundamental reforms in the operation of administrative organs and reformation of the bureaucracy aimed at the unity and efficiency of those organs.

"(*c*) Laying the foundation of national defense economy of which the keynote will lie in the autonomous development of the economy of Japan, Manchoukuo and China with Japan as the center."

The statement, in detailing economic policies, went on to set the program into the following categories: Establishment of a sphere of economic co-operation among Japan, Manchoukuo and China as one unit; Inauguration of a planned economy through the co-operation of the Government and the people; Establishment of financial control and the reinforcing of banking control directed towards the development of the total economic power of the nation.

Reorganization of the foreign trade policy so as to adapt it to the new world situation; Establishment of measures engendering self-sufficiency in the daily necessaries of the people; Epoch-making expansion in vital industries, especially in heavy, chemical and machine industries; Epoch-making promotion of science and scientific research and the rationalization of production.

Perfection and extension of communications and transport systems and facilities so as to adapt them to the new developments at home and abroad; Formulation and execution of a plan for the strengthening of national unity; Establishment of a permanent system and policy for strengthening the stamina of the people and physical strength of the race, and especially, fundamental measures for ensuring the security and development of agriculture and agricultural communities.

Adjustments to unequal sacrifices incidental to the execution of national policies, full operation of the various welfare measures and reform in the mode of living of the nation with the maintenance of a standard of living which will enable the nation to lead a plain, solid and vigorous life and surmount the national crisis by preserving through the years of hardship past and to come.

No "Toadyism"

Amplifying the Government's formal statement on foreign policy, Mr. Yosuke Matsuoka, Foreign Minister, said that "Japan is through with toadyism" and desires to establish a stability area embodying not only Japan, Manchoukuo and China but also Indo-China and the Netherlands East Indies.

The Foreign Minister emphasized that there was no change in the Japanese plans for the disposal of the China affair. The fundamental aim of the national policy, he added, would be the "construction of a new order in greater East Asia."

Therefore, he said, Japan's most urgent need at present and Japan's final aim "is the establishment of a stability zone embracing not only Japan, Manchoukuo and China but also Indo-China and the Netherlands East Indies."

The Foreign Minister said that the immediate aim of Japan's foreign policy was to establish and "create an East Asian chain of common prosperity, with the Japan, Manchoukuo and China group as one of the links."

Japan's mission, he said, "is enabling all nations and races to find for each its proper place in the world." Japan was strongly determined to achieve such fulfilment in concert with friendly Powers, he added. Mr. Matsuoka, however, did not mention any specific countries.

Japan will make positive efforts to make whatever friends possible under the prevailing environment, but would not make vain efforts to "grasp the hands of those countries who cannot be turned into friends," he emphasized. "Japan is through with toadyism."

He declined to comment on the European situation, other than to state that the non-involvement policy would be adhered to for the time being.

The Government, he added, will swiftly establish an "unshakable national structure of her own which will be adapted to meet the requirements of new developments at home and abroad.

The new Foreign Minister, Mr. Yosuke Matsuoka, favors the rapid propulsion of Japan's southward policy and plans the establishment of a "South Seas Development Company" with a semi-Governmental status and activities similar to the South Manchuria Railway, the *Hochi Shimbun* reported.

The undertaking might involve delicate relations with Germany, Britain, the United States and other countries, but the newspaper understood that the Japanese Government is firmly determined to "insure Japan's lifeline in the south."

American Opinion

Terming the new Konoye statement of policy as "very important," the *Washington Post* sees in it indications that Japan intends to establish regional dominance in East Asia similar to the hegemony Germany is creating in western Europe and the United States' efforts to consolidate the Pan-American bloc.

The *Post* notes, firstly, that the Japanese statement follows the Havana conference at which Pan-Americanism was transformed from pleasant platitudes into an embryonic American League of Nations with the United States playing a dominant rôle.

Secondly, the statement comes at a time when most Japanese have concluded that Germany is destined to dominate western Europe regardless of the outcome of its war with Britain.

Thirdly, the Japanese statement coincides with the speech of the Chairman of the Soviet Council of Commissars, Viacheslav M. Molotov, intimating that the Soviet Union no longer fears aggression by either Germany or Japan.

Reading these as signs of certain regional developments beginning to emerge, the *Post* says that, regardless of differences of motive and procedure, there is an obvious similarity in the United States' determination to maintain its position as dominant power in the Americas and Japan's and Germany's determination to play the same rôle respectively in the Far East and Continental Europe.

The paper points out that the Soviet Union constitutes the fourth regional combination while the British Commonwealth of Nations represents the fifth.

Declaring that the time perhaps has come that the subordination of weaker nations within the regional groupings must be countenanced more realistically, the paper says:

"Certainly no exception of principle can be taken of Premier Konoye's assertion. It is necessary to take a far-sighted view of the drastic changes in the international situation." Although the ultimate outcome of these changes is not clear, the statement constitutes "a further indication of the evolution toward a small number of powerful, regional combinations. On whether or not they can work amicably, with each other will hinge the question whether war will be circumvented or whether it will expand into an even more destructive conflict."

Also discussing Premier Konoye's statement of Japanese policy, the *Washington Star* declares that time alone will determine the precise meaning of the Japanese Government's greater Asia pronouncement. But the paper does not doubt that it contemplates an extension of Japanese hegemony, forcefully if necessary, over the Dutch East Indies and French Indo-China.

Stating that Foreign Minister Hachiro Arita's declarations have become defunct, the *Star* declares that Japan's new and more aggressive attitude is undoubtedly based on its belief of a Nazi victory rendering British sea power negligible in the Far East and also in its belief of American ineffectiveness.

The paper adds that it is becoming more evident that the post-war world will be ruled by force alone. Consequently, more important question than whether the United States can or should protect its position in the Far East, is whether it can defend its position anywhere.

British Opinion

The statement of policy issued in Tokyo by the new Japanese Premier, Prince Fumimaro Konoye, was the subject of extensive editorial comment in the British press.

It is said by the *Daily Telegraph* that for the most part there is not a great deal of difference between the latest Konoye statement and the recent radio address of former Foreign Minister Hachiro Arita, who said Japanese policy envisages the establishment of some kind of hegemony over the whole of Eastern Asia and an unlimited region vaguely described as the "South Seas."

The new Japanese Foreign Minister, Mr. Yosuke Matsuoka, in the newspaper's opinion, has gone no further toward definition than to mention specifically that French Indo-China and the Netherlands Indies fall within the Japanese sphere of interests and objectives.

"What has been added is a display of irritation," the newspaper declares. "We can only wonder why the Japanese Minister has thought it necessary to announce an abandonment of Japan's 'pat-on-the-back-for-everybody' policy.

"As a matter of fact, demonstrations of such geniality on the part of Japan have never been perceived. Its national dignity is none the greater for the vow that 'Japan will never endeavor to shake hands' with foreign countries. In fact, refusing co-operation has been part and parcel of Japan's foreign policy.

"The primary purpose of Mr. Matsuoka and Prince Konoye, namely, a complete settlement of the Chinese situation . . . . by taking advantage of changes in the international situation . . . . though Japan will keep out of European affairs . . . . will not be helped by hostile words against the United States and Great Britain and glances toward the Netherlands Indies. We can only regret that Japan has been impelled to strike such attitude."

The Konoye Government's announced policy is both comprehensive and ambitious, the *Manchester Guardian* says. But, "however big the pudding, the proof is still in the eating."

"There is to be a new order in greater East Asia," the paper rehearses, "and this is to be based on a complete settlement of the China affair, which means a political and economic bloc consisting of China, Japan and Manchoukuo.

"There is nothing new in this. There is nothing new in the second plank, whereby Japan's national fortunes are to be advanced by taking a far-sighted view of the drastic changes in the international situation. This only means that Japan will exploit any opportunities offered by the European war.

In conclusion, the *Manchester Guardian* declares:

"The new Japanese Premier has said his Government will co-operate very closely with the military. Foreign Minister Matsuoka has said Japan holds that every nation and race must be given its proper place in the world, which, in these days, usually means that each decides for himself what he shall gain and what someone else shall lose."

Foreshadows Axis Parley

Pursuing its policy of contributing toward the construction of the new world order which is envisaged in various aspects of the present international situation, the Konoye Government contemplates initiating in the near future diplomatic negotiations with Germany and Italy on questions to be settled by the three powers in co-operation, it is believed, says a diplomatic writer in the *Osaka Mainichi*.

Some circles urge, in this connection, that Foreign Minister Yosuke Matsuoka personally see to the negotiations as Nippon's chief delegate, in view of the importance of the problems to be discussed in the parleys.

It is understood that among the issue to be taken up for discussion will be various measures to maintain world peace on a regional basis among the Greater

East Asia common prosperity chain, the Italo-German lebensraum in Europe, the pan-American Union, and the U.S.S.R.

The maintenance of world peace on a regional basis is intended as the condition for the construction of a new world order.

The diplomatic negotiations among Nippon, Germany, and Italy are also presumed to refer to such vital questions of the world as those of colonies, redistribution of raw material resources, and a new world financial system.

The Konoye Government's intentions relative to the tripartite negotiations, it is believed, are to create a strong political tie binding Tokyo, Berlin and Rome, thereby serving the cause of the creation of a new world order.

It is reliably learned that the Konoye Government will strive to readjust relations between Nippon and Soviet Russia with the viewpoint of facilitating the creation of the Greater East Asia common prosperity chain, even at the risk of friction between Nippon and the United States to some extent.

Government quarters, it is reported, are considering the dates for holding the three-power negotiations and for Foreign Minister Matsuoka's visit to Europe.

Shiratori Active

Measures for Nippon's approach to Germany and Italy were recommended by former Ambassador Toshio Shiratori to Rome to Premier Prince Fumimaro Konoye in their interview on August 2, it was revealed.

Authoritative quarters report that after exchanging views with the Premier on the question of foreign policy now confronting Nippon, Mr. Shiratori asserted:

"In taking diplomatic measures for still closer co-operation among Nippon, Germany and Italy, Nippon should take the initiative at the earliest possible opportunity prior to the German general attack on Britain.

"The strengthening of political relations among the three powers will be feasible if Nippon expresses her readiness to co-operate with Germany and Italy in the construction of a new world order. Nippon, in this connection, will have to seek the understanding by Germany and Italy of her policies applicable to the South Seas region and the United States. The nature of those policies must be fixed as early as possible in a manner co-operating with those of the Axis powers."

It is further reported that Mr. Shiratori proposed that Foreign Minister Yosuke Matsuoka visit Berlin, Rome and Moscow in connection with the strengthening of relations among Nippon, Germany and Italy.

The ex-ambassador to Rome, according to authoritative quarters, urged that the Foreign Minister personally negotiate with Fuehrer Adolf Hitler, German Foreign Minister Joachim von Ribbentrop, Premier Benito Mussolini, and Soviet Foreign Commissar Vyacheslav Molotov.

Mr. Shiratori, it is reported, requested Premier Prince Konoye fully to consider his proposal.

The former ambassador, in conjunction with Lieut.-General Hiroshi Oshima, former envoy to Berlin, has been conducting since last autumn a movement for the conclusion of alliance among Nippon, Germany and Italy and a non-aggression pact between Nippon and Soviet Russia.

With the prospects for the success of his drive brightening, following the formation of the Konoye Cabinet, Mr. Shiratori has positively supported the Premier and the Foreign Minister in the field of foreign policy.

Says the "Chicago Tribune"

In an editorial on the realities of the present-day world of strife, and on what policies can be best adapted for mutual protection and survival in such a warring world, *The Chicago Tribune* on May 30 urges the renewal of the Washington-Tokyo trade treaty as a seven-league step in that direction.

The *Tribune*, appealing for a conciliatory policy looking toward an early settlement of all differences between Washington and Tokyo, said in its editorial:—

"We are talking excitedly of armaments and Congress is voting the money in billion-dollar bills. War material is coming out of the mills on Capitol Hill, *but it is not coming out of the factories*, and for a long long time it will not be coming out of them. In the meantime we are neglecting to improve a situation affecting our Pacific frontier. The opportunity is there, and if this nation would make use of it could double the power of its fleet and do more in a short time to increase the strength of its defenses than it can do in a year of production, even on a 24-hour day and a seven-day week.

"The United States and Japan can come to a friendly understanding. There is no obstacle in the way except the determination of some Americans to dominate Japan's policy in China. Japan needs peace with the United States. Japanese statesmen may be looking at the future with as much uncertainty as prudent Americans. In a world rapidly changing from its old historical trends and whirling off its old historical foundations, Japan may feel quite as dubious as the United States. Many overtures have been made by Japan for an understanding which would deal with what is real in the relations of the two countries and avoid what is superficially conflicting.

"The United States at this time cannot afford to conduct its foreign relations wholly on moral pre-conceptions. America may be able to aid China a great deal more effectively if it isn't quarreling with Japan than it can by keeping up a futile bombardment of threats and hard words which have done the Chinese no good and can do America a great deal of harm.

"This country cannot afford to have an enemy in the Pacific. It is not necessary to have one there. Peaceable trade can be resumed and a peaceable understanding can be had. That understanding would rest upon material advantages which Japan would obtain from friendship with the United States and, therefore, would have the promise of an enduring understanding.

"Japan need not be driven into the German-Italian camp. If events progress as they have been doing in Europe the British and French interests in China will be canceled out. Japan then will have won a major campaign. Its policy has been, in a way, a duplicate of our Monroe Doctrine. Japan has objected to the entrenchment of powerful European nations off its coast, just as we would object to the same thing in relations to our national life.

"Japan would be disposed to be more reasonable if Chinese ports and forts were not in European hands. China itself will be better satisfied to know that the foreigner is out.

"The Japanese are more willing now than ever to come to a settlement in China which will relieve them of a protracted and expensive war. That may not be possible at once, but an understanding between the United States and Japan might do more to conciliate the Chinese question than can be expected from the present bellicose attitude of the American government.

"If we intend to keep our Pacific front bristling with threats the Japanese *will look for their associations in other* quarters and we know exactly where that will be. If the people in Washington who are rushing to arms in fear of a danger to the Eastern front are sincere, if they mean to take precautions and provide against the future, they'll protect the Western flank by making a friendly arrangement with the power which controls the Far East.

"They won't so manage American affairs that trouble in the Atlantic will be accompanied by trouble in the Pacific. While they are passing a billion-dollar appropriation for the American navy they won't continue to make it necessary to keep the battle fleet on its Honolulu base.

"By accepting the Japanese overtures they can double the strength of the fleet immediately. The best defense policy of the United States could be written within a few weeks in a renewed trade treaty with the Japanese. That peaceable treaty would immediately enable the United States to use its fleet in the Atlantic if that's where it is needed. It would not be tied as now to the Pacific. In effect the strength of the fleet would be doubled by cutting half its problem away."

Not An Embargo

President Roosevelt by proclamation on July 26 limited new Government restrictions on United States exports of vital defense materials to high-test aviation gasoline, aviation lubrications and aviation gasoline.

The proclamation virtually eliminated all supposition provoked earlier by the announcement of the inclusion of petroleum, petroleum products and scrap iron in the United States export license system that the restriction were directed against Japan or that at least they threatened to impair Japanese-American trade relations.

Officials at Washington say that, as a result of the proclamation limiting gasoline and petroleum export restrictions, the new regulations should have very little effect on Japanese oil purchases in the United States, of which nine-tenths are crude petroleum.

The President's proclamation also discloses that the license system will apply only to export of No. 1 heavy melting scrap iron, which likewise reduces the potential effects on Japanese purchases of that commodity.

Commenting on the inclusion of oil, oil products and scrap metal in the export licensing list during a press conference President Roosevelt said he was moved solely by national defense requirements. The extension of export control was prompted primarily by a shortage of high-octane gasoline in the United States, he said.

The President asserted emphatically that the new order does not in any way constitute an embargo.

Meanwhile, the Japanese Ambassador, Mr. Kensuke Horinouchi, called on acting Secretary of State Sumner Welles to discuss the effects of the new regulations on Japanese trade. It is believed the Ambassador sought clarification on the methods by which the Government intends to enforce the restrictions.

Can Still Import

The Government experts disclosed that from 75 to 80 per cent of Nippon's scrap metal purchases in the United States are not touched by the new export licensing system. However, it is pointed out that all Nipponese purchases could be brought under control or embargo at any time merely by changing regulations.

Officials said that such changes would be made only if it is found that the defense needs require that metal should be kept in the United States.

The reason responsible for the fact that such a large share of the Nipponese purchase is placed outside the licensing system is that the existing regulations apply only to No. 1 heavy melting steel and iron scrap.

The goods added to the list of commodities subject to the export license system of the United States by the President's order of July 26, effective August 1, are as follows: (Taken from the *Tusyokyoku-Nippo*, issued by the Foreign Office).

(*a*) Petroleum products

(1) Aviation motor fuel, i.e., high-octane gasolines, hydrocarbon, and hydrocarbon mixtures (including crude oils) boiling between 75 and 350 F. which with the addition of tetraethyl lead up to a total content 3cc per gallon will exceed 87 octane number by the ASTM knock test method; or any material from which by commercial distillation there can be separated more than three per cent of such gasoline, hydrocarbon or hydrocarbon mixture.

(2) Aviation lubricating oil, i.e., any lubricating oil of 95 or more seconds Saybolt universal viscosity at 210 F. with a viscosity index of 85 or more.

(*b*) Tetraethyl lead, pure tetraethyl lead, ethylfluid, or any mixture containing more than 3cc of tetraethyl lead per gallon.

(*c*) Iron and steel scrap No. 1 heavy melting scrap.

Stocks Are Low

Robert Wolcott, president of the Luken Steel Co., on August 2 said that independent manufacturers of steel are about to ask restrictions on sales abroad for all grades of scrap steel because steel makers estimate that the present stocks of scrap in the United States are equivalent only to about six weeks' consumption by industry.

Avoiding Clash

Official United States action seemed to be aimed at avoiding at present a direct clash with Japan while Anglo-Japanese tension was increasing.

Officials were disturbed over the latest turn of events in the Far East, especially with regard to reports of anti-American sentiment in Japanese-occupied areas of China, but a Government spokesman insisted that all matters were being handled in a routine manner.

The Government hoped, he added, that all problems, such as the order by the Japanese-controlled Nanking régime for the expulsion of six American newspapermen and publishers from Shanghai, could be settled locally.

The export license power will be used on an hour to hour basis, it was understood. The United States was prepared to act generously as regards to shipments of petroleum and scrap metal to Japan if Japan would show a similar liberal policy in the Far East toward American interests and nationals.

One official believed that the recent rapid development of synthetic rubber, which one tyre-maker put on the retail market, made the United States less susceptible to any Japanese retaliation in the Far East if the United States should find it advisable to enforce strict embargoes.

Anticipates Friction

Warning Japan that she must risk some friction with the United States over the Netherlands East Indies the rubber of which was indispensable to American industry, Gen. Kuniaki Koiso, former Overseas Affairs Minister who has been informally chosen to be the special Japanese envoy to the Netherlands East Indies, stressed to newspapermen that the change in the international situation made it absolutely necessary for Japan to build up an economic sphere of Greater East Asia, including not only Japan, Manchoukuo and China, but the South Seas region as well.

Pointing out that the Netherlands East Indies had been "exploited and oppressed for a long time as a foreign colony," Gen. Koiso asserted that the construction of a new order in East Asia dictated that "these South Sea islands should not be left under their present status for ever."

"Viewed in a moral light," said the General, "the emancipation of all oriental peoples was destined to be carried out by all means."

China might be more valuable as a market, but Gen. Koiso gave it as his opinion that the oil, rubber and tin produced in the Netherlands East Indies were also valuable in the world market.

Japan, Gen. Koiso said, had no intention of monopolizing these products but feels it necessary to seek their fair distribution.

For that purpose, however, Gen. Koiso warned Japan that she must risk some friction with the United States whose industry depended largely on rubber from the Netherlands East Indies.

Economic Measures

The vital necessity for Japan to attain economic self-sufficiency so that she may stand alone without depending on Great Britain, the United States, or any other nation, was stressed by Mr. Ichizo Kobayashi, Minister of Commerce and Industry, in an interview with the press in which he clarified the seven basic items of commercial and industrial administration.

The Minister of Commerce and Industry particularly stressed that the keynote of the low-price policy consists in an adjustment of supply and demand, by providing the people with an abundance of low-priced commodities after the existing dormant production organs have been brought to life.

Powerful leadership on the part of the authorities will be necessary for the successful execution of this plan, Mr. Kobayashi emphasized. In clarifying the seven basic items of commercial and industrial administration, Mr. Kobayashi declared:

(1) Japan must attain economic independence by the foundation of a great East Asiatic economic bloc. Such a bloc must be established as will be able to stand alone without depending on the United States, Great Britain, or any other country.

(2) For the establishment of such a bloc, Japan must strengthen general mobilization on the domestic front. She must also strive for increased production with the highest possible efficiency, and at the same time decrease the cost of production.

(3) The low-price policy which hitherto has been followed, was carried out with financial quarters as its center. There is a need, however, to take various measures which will accelerate the production of abundant and low-priced commodities.

(4) In adopting the system of co-operation between officials and civilians, we must seek civilian co-operation in the formulation of national policies. Such civilian co-operation must be given a free hand to the extent of their experiences and abilities.

(5) In order to bring about the new system of Government organization, we must first of all simplify the business of Government offices, principally by eliminating the "red tape."

(6) As for the strengthening of productive power, we must observe the principle of "importance first," and strive

especially for an epoch-making production of iron ore and coal.

(7) We must make very effort to carry out various measures to develop science, and to strengthen, the corps of technicians needed for the establishment of a nation which is based on national defense.

Lesser Sensation

Sensational among Far Eastern events during the past month was the arrest in various Japanese centers of prominent Britons on suspicion of espionage, and arrests in London, Hongkong, Singapore and Burma of Japanese nationals by British authorities on like charges. The arrests flashed on the news scene like a skyrocket, and disappeared almost as abruptly with the release of most of the suspects after questioning, followed by a cordial interview between Mr. Yosuke Matsuoka, Japan's new Foreign Minister, and British Ambassador Sir Robert Craigie.

The one tragic note of the events was the death of Melville James Cox, Reuters news agency correspondent in Tokyo, who died of injuries when he leaped out of a second floor window in the Tokyo military police headquarters.

A detailed report of the Craigie-Matsuoka meeting was forwarded the London Foreign Office, and it is understood the British Government has attained a better understanding of the intentions of the Japanese authorities. Tension subsided accordingly.

Japanese Opinion

The *Hochi Shimbun* understands that the Japanese Government is viligently watching Britain's movements while the *Nichi Nichi Shimbun* urges the Foreign Office to deal with the question with a firm attitude in an effort to turn the misfortune into a blessing, "though diplomatic negotiations may in the worst eventuality have to be followed by a resort to force."

Under the caption "Withdraw Japanese Residents from England" the *Kokumun Shimbun* points out that Great Britain created the *casus belli* in carrying out retaliatory arrests of Japanese residents in London and other parts of the British Empire, though it might be premature to jump to the conclusion that Britain had risked war with Japan by her action.

News of release of Mr. Satoru Makihara, manager of the London Branch of the Mitsubishi Trading Company, who had been arrested by British authorities on August 2, was given prominence in the Japanese papers at the time.

British Troops Quit China

British troops that have been stationed in Shanghai, and North China are being withdrawn for service elsewhere, it was officially announced on August 10 by Major-General F. Keith Simmons, G.O.C. British troops in Shanghai and North China. A similar announcement was also made by the War Office in London. Leaving Shanghai, Tientsin and Peiping under the order will be the 2nd Battalion, The East Surrey Regiment, the regular battalion on duty in Shanghai, the 1st Battalion, The Seaforth Highlanders, whose regular station is Hongkong and who are on temporary duty in Shanghai, a detachment of the Royal Army Medical Corps, whose headquarters are at the British Military Hospital in Central Road, a detachment of the Royal Army Service Corps with headquarters at Ash Camp, detachments of the Royal Engineers, Royal Corps of Signals, Corps of Military Police, Military Provost Staff Corps, whose headquarters are at the Detention Barracks in Tifeng Road, Royal Army Pay Corps and Army Dental Corps.

The announcement of the withdrawal of British troops from China was the subject of widespread comment and widely differing interpretations were placed on the action of the British Government. In some quarters the action was construed as another move to appease Japan, but it was also pointed out that the withdrawal might be regarded as a strategic retreat from an untenable position, and it was conjectured that the forces leaving China were being removed to another station in the Far East, such as Hongkong or Singapore. The number of forces being shifted total two thousand officers and men. An immediate reaction in Shanghai to issuance of the withdrawal order was another slump in the value of the Chinese dollar.

Following a conference on August 15 of all the commanders of foreign forces stationed in Shanghai it was announced that defense sectors in which the British troop had been stationed in Shanghai would on their departure be allocated to the American Marines and, in the western environs of the Port, to Japanese troops.

To this arrangement the Japanese authorities, both in Shanghai and in Japan dissented after the Japanese Commander had voted against the proposed arrangement at the meeting of the various military leaders. Then a new arrangement was brought about under which what is called "B" sector, which the British forces formerly had guarded, was placed under protection of the Shanghai Volunteer Corps.

Wealth of The N.E.I.

America's stake in the Netherlands East Indies whose future fate the entire world is watching since the conquest of Holland by Nazi Germany, has been an ever-growing one for years past, according to the Institute of Pacific Relations.

A complete survey of American interests there recently completed by the Institute reveals that as a source of vital raw materials for the United States, the Netherlands Indies has worked up from fifteenth place in 1933 to eigth place in 1938 and seventh place in 1939.

At the present time, the Institute revealed, American Oil companies now control 40 per cent of the oil interests of the islands through the Standard Oil Companies of New Jersey and California, and occupy fourth place among holders of rubber investments in the Indies through the U.S. Goodyear Co., Firestone Tyre and Rubber Co., and the Goodyear Tyre and Rubber Co.

The entrance of the American rubber interests in the islands was for the purpose of freeing themselves from dependence on foreign sources, according to spokesmen.

These are some of the reasons, the Institute states, that probably dictated the strong attitude taken by Secretary of State Hull in his warning of April 17 that the United States could not remain indifferent to any change in the status of the islands, because the United States, like many other countries are dependent on them for vital raw materials such as rubber, tin, quinine and copra.

Holland, as a matter of fact, had almost a world monopoly on quinine as a result of the production in the Netherlands Indies.

The survey stated that the American investments in the Netherlands Indies are not so important as are the sources of raw materials. This is partly due to the fact that for years the Dutch favored British rather than American capital.

However, in 1929 American investments there reached a peak of $201,300,000.

The tendency for American interests to expand was very marked in the beginning of the present year, the survey said. The Philippine Manufacturing Co., a subsidary of Proctor & Gamble, had planned to lease 10,000 square miles of land for cultivation of palm trees and to construct a plant for the manufacture of palm oil.

Another American company, whose name was not disclosed was reported ready to set up a margarine factory in Soerabaya.

The construction of a U.S.$4,000,000 high-octane aviation gasoline plant by the Standard Oil's subsidary company there was recently completed.

Other American companies with holdings in the islands are Colgate Palmolive Peet Co., General Motors Co., R.K.O. Radio Pictures, Inc., and Stein Hall Trading Co.

From the standpoint of investments, the United States in 1929 ranked fourth. Out of a total foreign investment of 2,065,000,000 guilders, the Dutch accounted for 74.4 per cent; British, 13.5 per cent; French-Belgian 5.4 per cent; American 2.6 per cent and Japan 0.9 per cent.

Most of this is invested in the production of sugar, rubber, tobacco, oil palm, coffee, tea, cinchona, fibres, coconuts and gambier.

A New Dictator

Probably the most sensational happening of late in the Far East is the act of the Philippines National Assembly passing the Emergency Defense Bill by 62 votes to one, endowing Senor Manuel Quezon with dictatorial powers. Needless to say this action has profoundly shocked public opinion in the United States, though it is still too early to ascertain what are likely to be the ultimate repercussions.

This astonishing act of the Filipino legislature has robbed every Filipino of those rights which were assured to him when the United States wrested the islands from Spain, and even though Senor Quezon may contemplate no more than a benevolent tyranny, it has to be remembered that most of the present tyrannies started off with that idea only to degenerate into systems of government under which the people dare hardly call their souls their own.

Much comment was created at the time of the passage by the British Parliament of legislation suspending for the duration of the war constitutional rights, which are the very life blood of the democratic ideal. That action was justified by the circumstances prevailing, but it cannot by any stretch of imagination be said that any such conditions are at present to be found in the Philippines. The only impression to be formed is that Senor Quezon, despite some criticism, has succeeded in stampeding the National Assembly into taking action which the Filipinos may have every reason ultimately to regret.

Senor Quezon advances the usual threadbare arguments in favor of the abolition of the party system, and the eradication of opposition to the government. His declaration that the system operates against efficiency in government may have something to be said for it, for democracies are shown to be slower than autocracies. But against this the example of Germany, where the Nazi leaders have accumulated vast fortunes, by methods which will not bear any close scrutiny, proves that the one party system is in itself calculated to foster all those abuses which would never occur in a political system where freedom of criticism prevailed. If Senor Quezon by his action hopes to establish adequate defenses against the potential menaces which threaten the Philippines, he is likely to be grievously disappointed. His nationals are completely unable to stand on their own feet or resist any such designs as may be levelled against their independence. For this negation of the very freedoms for which the United States stand cannot but serve to alienate whatever sympathy was felt for the Filipinos, and possibly lead to a revision of United States opinion concerning the desirability of assisting in the defense of the Islands.

If ever that came about Senor Quezon would have proved to have committed the gravest offence against the safety of his own countrymen, and to have paved the way for their subjection to another Power. The forces of the United States are vitally necessary to the Philippines if the latter are to gain and maintain their independence, for there is no gainsaying the fact that without such assistance the Filipinos could not hope to save themselves from falling beneath the domination of an outside Power.

That Senor Quezon has shown himself an adroit politician the history of the Filipino independence movement clearly shows, but there is nothing to indicate that the mental and moral stature of the man qualifies him to undertake the heavy responsibilities which he has shown himself so eager to assume. The powers which have been conferred upon him are indeed extensive, and only the United States' High Commissioner stands between him and complete dictatorship. But the Commissioner's power to prevent Senor Quezon from assuming control of coconut oil excise tax rebates is just about as far as he is able to go. Much will, therefore, depend upon the line of action Senor Quezon follows in the next few months, and for the present all that can be said is that while he appears to have strengthened his personal position *vis-à vis* of his own people, there is a very grave danger that he has weakened their position in the light of all that might happen to them in the future.

Reaction in the U.S.

The Philippine National Assembly's grant of dictatorial powers to the Commonwealth President Manuel Quezon yesterday was greeted with open criticism in congressional circles.

Senator William H. King of Utah, who wrote the plank in the Democratic platform of 1920 calling for full Philippine independence, said he believed "many Senators and Congressmen will want to know more about Sr. Quezon's request." He said, however, that judgment should be withheld until more complete details have been revealed.

Mr. Fred L. Crawford, Republican Representative of Michigan, condemned the Assembly's action.

"President Quezon is riding high, wide and handsome," he declared. "We are letting him get away with it. The intent and spirit of the Philippine constitution and the Independence Act was that the islands should follow our form of Democratic Government. Is Quezon to say whether an emergency exists or is the United States Government to ?"

Mr. Crawford contended that the powers granted the President of the Philippines violate the Independence Act and the Philippine Constitution. He said, however, that he did not believe the United States would take action.

The *Washington Post*, in an editorial, said, "It is a very real question whether Sr. Quezon's Emergency Powers Bill does not contravene the spirit and letter of the Commonwealth's constitution and thus of the Independence Act. In any event, we are now witnessing the strange spectacle of a nation which clamoured for independence because it was capable of self government turning totalitarian even before independence is fully achieved."

The newspaper recalled that the late Louisiana Senator Huey Long once argued that Fascism might come to a nation under the guise of anti-Fascism. This paradox has not proved true in the United States, the newspaper said, "but there is one area under the Stars and Stripes where it appears to be receiving startling confirmation."

The *Post* said Sr. Quezon asserted that he was opposed to dictatorship.

"Yet, at the moment he was protesting his love for Democracy, he was asking the National Assembly to vest him with practically absolute powers."

Additional powers for President Quezon may have been inevitable because of world conditions and the serious situation in the Philippines, the *Post* continued.

"Yet, the extent of the authority demanded strongly suggests that Sr. Quezon's ardour for Democracy is not very deep," the newspaper declared.

Hits Japanese Trade

Sig. Benito Mussolini's entry into the European War will have a serious though indirect effect on Japanese foreign trade and even on local industries, economic quarters declared.

They pointed out that not only will Japan's trade with Italy be affected, but, since, Allied fleets will blockade Italian colonies and close the Mediterranean, trade with Italian Somaliland, Near Eastern Countries, Egypt and the Anglo-Egyptian Sudan, will suffer greatly. Moreover, the same quarters stated, the conflict threatens to spread to the Balkans, the Near East and Arabia.

The total value of all this trade is highly important to Japan, they added. Japanese exports to North Africa and Italian Somaliland alone amounted last year to Y.40,000,000, while imports came up to Y.37,000,000; Exports to the Balkans, the Near East and Arabia amounted to approximately Y.35,000,000, and exports to Italy to Y.5,700,000.

Japan's chemical industry will be particularly hard hit since imports of salt from Africa and mercury from Italy will now be cut off, it is believed. Cotton supplies from the Near East and Egypt will also be greatly reduced.

Japan's already hard-pressed mercantile marine, too, will suffer, for with the Mediterranean closure, European-bound Japanese ships will have to make the long detour around the Cape if they are to continue service to the Continent.

To Manufacture Tools

The Japanese Commerce and Industry Ministry is moving to meet the effects of a restriction or complete ban on machinery and machine tool exports from the United States, says the *Aschi*.

Most ambitious of the emergency plans is the establishment of another national policy company. This firm would devote its full attention to the manufacture of large-size machine tools and parts (probably rolling mill equipment). Participants in the venture would be Japan's five major manufacturers of machine tools (Japan has been shut off largely from the large-size machine tools which Germany formerly supplied. The United States, however, even before the war dominated the Japanese large-size machinery import market).

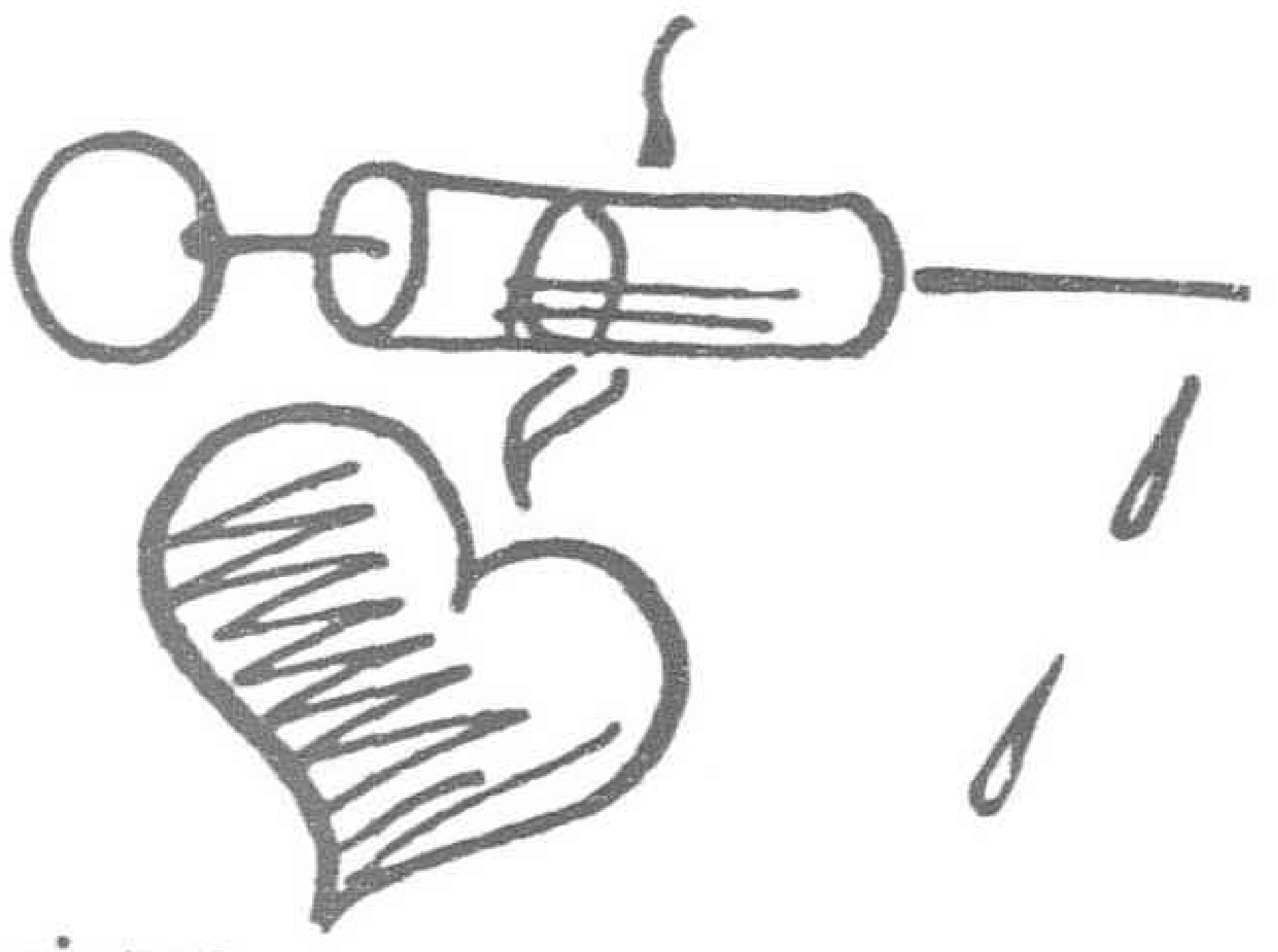
The Government would give this company priority in the supply of materials. Subsidies and bounties would be provided.

A second Government plan now under consideration is the control of the production and distribution of machine tools in Japan.

These and other possible steps to meet the present emergency will be discussed at a Government-called conference of machine tool manufacturers in the near future.

Tea Leaves from Lo Pat's Garden

by Shamus A'Rabbitt



We speak of couples knowing their own minds
Before taking the fatal step in matrimony
As though future changes in their lives
Could be guarded against
By matrimonial vaccination.

◆◆◆◆◆◆

Many a man through inexperience
Builds his house upon the sands
And later transfers it to higher ground
But in marriage he is supposed
To remain for life
Upon the mud-flats of mediocrity.

◆◆◆◆◆◆

The greatest insult ever offered to woman
Is contained in the expression:
" Marry and settle down."
Woman should demand
" Marry to reach the goal of success
In half the time
That it can be attained singlehanded."

◆◆◆◆◆◆

The man who treats his wife
As a business partner
And consults her before making a loan
Holds few dishonored notes
On the Bank of Experience.

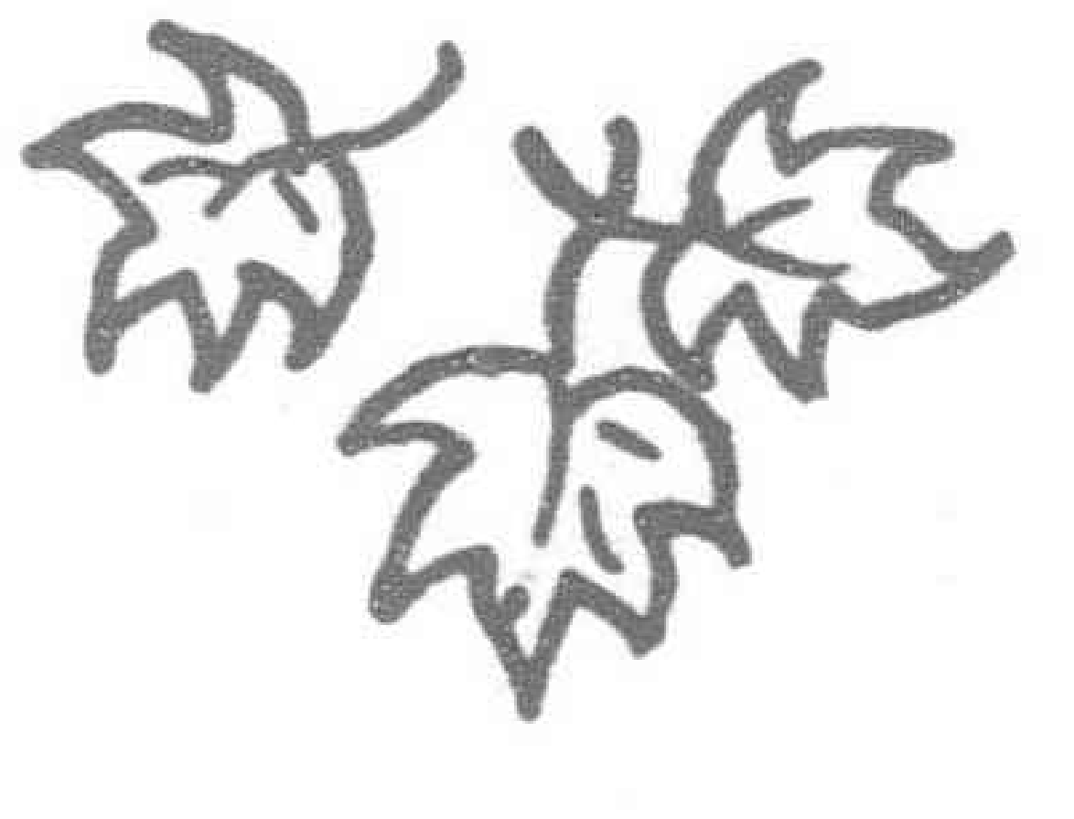
◆◆◆◆◆◆

The man who considers a woman as a chattel
Speaks of " damaged goods "
Whilst he who accepts her as sister—soulmate—friend
Honors her failings as he excuses his own.

◆◆◆◆◆◆

To define wisdom
One must have wisdom—
To define the Deity
One should be divine.

◆◆◆◆◆◆



Slaves to conventions
Use mental fig leaves
To conceal God's handiwork.

◆◆◆◆◆◆

Prejudice magnifies accessories
And obscures fact.

◆◆◆◆◆◆

In days of rapid transit and hard money
The man who walks with his head in the clouds
Must expect the more worldly portion
Of his anatomy to receive a jolt.

O where O where has my little laugh gone?
'Tis smothered by dignity—
With my smile cut short and my frown cut long
I'm a sad looking bird to see!

◆◆◆◆◆◆

If the average man were less afraid to laugh
When sober—
There'd be less drinking.

◆◆◆◆◆◆

The Good Lord made us all convivial
But conventions have encrusted us with the shell
That often takes the extra drink to open.

◆◆◆◆◆◆

Reserve collects on us with age
Like barnacles on a ship—
And like the barnacles
Impedes our progress
To the " Land O' Good Cheer."

◆◆◆◆◆◆

If children were as artificial as their elders
They'd have to take a cocktail
Before enjoying their games.

◆◆◆◆◆◆

Some men laugh so seldom that
When they do—
Their friends think they are drunk.

◆◆◆◆◆◆

The unhappiness of many a modern wife
Is due to the lack of the menial labor
Which kept her grandmother contented.

◆◆◆◆◆◆

Ease and luxury are responsibilities
Borne with eclat by the aristocrat.

◆◆◆◆◆◆

The great and simple can achieve happiness
With or without possessions.

◆◆◆◆◆◆

If to live
A man must know war
Love, wealth, poverty, honor, disgrace—
Have delirium tremens, and go to prison—
No wonder the price of life is death.

Japan and Manchoukuo's Industrial Development

By *BARON KIMMOCHI OHKURA*

(Contemporary Japan)

IN 1918, when a dazed world found itself finally at peace, who would have thought that a little more than twenty years later Europe would be in the throes of a war of even more terrible dimensions? We are witnessing to-day a great tragedy of mankind, a tragedy which cannot be ascribed merely to the ambition of a single nation but one which is the outcome of a number of causes. And chief among these is the insistent demand for a new political and economic order—the conflict between what has been and what is going to be.

The first challenge was hurled at the old order when the contrast between the "haves" and "have nots" of the earth become too glaring to be ignored. When there is too big a gap between the "haves" and "have nots" of society, the State is able to step in and make appropriate adjustments in order to preserve peace, but when there are inequalities among nations, each State must contrive as best it can to settle the problem within its own domain. In such circumstances, if the "haves" are so lacking in wisdom and foresight as to pay only lip-service to the cause of peace, while they unashamedly pursue only their own profits, then they can never hope to calm the discontent of the "have nots."

In recent years the capitalistic system, having already passed its apogee, has been showing signs of decay. Just as among individuals it had begun to reek of corruption, so in dealings among nations its inherent defects were made glaringly apparent; all each nation sought was to profit itself at the expense of others. The inevitable reaction first made itself felt within the "have not" nations; there began a movement to oust the pursuit of individual aims from the first place in the life of the nation and to substitute the attainment of the common aims of the State as a whole. This naturally led to a clash between the die-hard supporters of individualism and the apostles of the new order.

Another cause of the present European war was the ideological chaos in which the peoples of the world had been floundering. There was a decline of faith in democracy, which resulted in the rise of new ideologies. Communism, the first of these, opened up a way diametrically opposed to that shown by democracy, while later the fascism of Italy and the totalitarianism of Nazi Germany arose in opposition to both communism and moribund ideals of democracy. The world thus became the arena for a three-cornered fight between democracy, communism and totalitarianism. Not only were the people in each nation divided one against the other; the next development was an alignment of the nations themselves into blocs favoring one or other of these ideologies.

As I have said before, it was because the "haves" thought only of their own profits and felt no remorse over sacrificing the interests of the "have nots" according to the principles of capitalism, that they were so ready to suspend free trade, erect high tariff barriers and restrict or prohibit immigration—in short, to resort to brute force in the economic sense. Because of this universal tendency, the free circulation of materials was obstructed at every turn, money became tight and national feelings were irritated, furnishing yet another cause for the present catastrophe.

Still another factor was the failure of Wilsonian idealism. After the last Great War, the late President Wilson had great hopes for the world, but these were not realized. Among other things the doctrine of racial self-determination was not practised with the necessary insight, with the regrettable result that further friction was engendered among the nations.

From the above considerations, it can be seen that the present war was the outcome of forces too strong to be stemmed by the exercise of conventional statesmanship; it was unavoidable under the existing conditions. Nations with a long and peaceful history have disappeared one after the other, while at this very moment men are killing and maiming each other and making ruins of the material monuments of peace-time endeavor. No tragedy on such a gigantic scale has ever been enacted since history began. But much as our attention is focussed on immediate events, we must fulfil what I believe is our sublime duty and think on how a new order can be built out of the ruins of the present catastrophe. We must set up a bulwark against similar catastrophes in the future.

Incredulity was the reaction of most people in Europe and America when Prince Konoyé, in 1938, issued his famous statement disavowing any intention on Japan's part to seize Chinese territory as a trophy of war or to demand any reparations from the Government of China. It was suspected that the Konoyé statement was merely a gesture designed to hide some secret deal being arranged by Japan. Such a misconception, however, was natural in people who were unable to realize that Japan's far-sighted Premier at that time had realized the necessity for a change in the time-honored conceptions of peace-making. Prince Konoyé understood that the practice of one nation invading the territory of another merely to reap profit for itself was already out of date.

After all, the example of Manchoukuo was ready to hand. Manchoukuo was founded with the aid of Japan in March, 1932, as an experiment in the realization of such an ideal. To this day it is a stock joke among Americans to refer to Manchoukuo as a puppet State; whereas if they could only remove the scales from their eyes and see what progress the new nation has achieved in the past eight years, they would realize how significant and worthy the Manchoukuoan experiment has been. The establishment of a new other in the world under which the principles of "live and let live" and mutual prosperity would prevail is attainable, in fact, by the founding of just such nations as Manchoukuo.

During the period of twenty-three years previous to the founding of Manchoukuo, the Manchurian region, nominally under the control of the Chinese Government, was in the hands first of Marshal Chang Tso-lin and later of his son, Marshal Chang Hsueh-liang. It was then a neglected section of the Asiatic continent, wild and undeveloped and ruled on feudalistic lines. The ruling class of war-lords severely oppressed the various races that peopled the region, wresting from them what they earned as the result of long and arduous toil. The vast natural resources of the country remained undeveloped; nor could Russia or Japan, which hemmed in the region to the north and south respectively, undertake any development of Manchurian resources because of Chinese interference. Anyone who has lived in Manchuria during that period will not easily forget the hopeless state of the country at the time.

Japanese aid to Manchoukuo, which has been given unstintedly, has taken countless forms, of which seven, however, may be mentioned as outstanding. In the first place, Japan has invested huge sums of money in the industrial development of the new country. Secondly, by establishing cultural centers all over the country, she has made the life of the Manchoukuoan people more cheerful and civilized. Thirdly, Japan has unified the Manchoukuo currency by effecting a major reform in the country's monetary system. Fourth, she has abolished extraterritoriality for her subjects in Manchoukuo. Fifth, she has established peace and order within the country and built up its defences against invasion from the north. Sixth, she has brought about harmony among the five races of Manchoukuo, namely Mongols, Russians, Koreans, Chinese and Japanese, and thus established an ideal nation of mixed population, while at the same time contributing to the solution of the world race problem. And finally, Japan has not only invested funds in Manchoukuo, but has also placed at the service of the new State a body of officials and experts of the finest type available.

It is obviously impossible to discuss all these points in an article of this nature; therefore we will confine ourselves to a discussion of industrial development in the new State as a result of capital investment. Since the founding of Manchoukuo, Japan has had to bear the whole burden of investment there as a result of the refusal of other countries to put up any capital. And it is not as if Japan had any capital to spare; on the contrary, she is anxious to have foreign countries invest in her own domestic enterprises. Nevertheless, Japan has managed by dint of great effort to invest in Manchoukuo over the period of eight years, from 1932 to 1939, the huge total of Y3,039,000,000.

The biggest item in this account is the net increase in the paid-up value of the shares and debentures of the South Manchuria Railway Company—a total of Y1,136,000,000. Companies affiliated with the S.M.R. have also floated notes and debentures to the amount of Y740,000,000, while outside companies have put up a total of Y645,000,000 among themselves. The Manchoukuo Government itself did not float its own industrial bonds until 1939, in which year it floated government bonds to the amount of Y135,000,000, all of which were absorbed in Japan. With such huge sums invested, it is of course hardly surprising that economic construction in Manchoukuo should have progressed so rapidly.

In this connection, the most conspicuous progress has been made in the field of transportation. In 1931 the total length of railways in Manchoukuo was about 5,800 kilometers, of which S.M.R. lines accounted for 1,129 kilometers, Chinese state lines 2,936 kilometers and the Soviet North Manchuria Railway 1,733 kilometers. Since then, all this mileage has been transferred to the control of the S.M.R. and many new lines added, bringing the total mileage to-day to well over 10,000 kilometers. In 1931, the amount of freight transported over the existing lines was 14,000,000 tons and the number of passengers 11,000,000, whereas in 1938 there was an increase to 39,000,000 tons and 50,000,000 passengers respectively. The advantage of this progress to the people can be readily comprehended.

But even more striking has been the development of roads. Under Marshal Chang Hsueh-liang's rule almost no regular road existed in Manchoukuo outside the cities, but to-day there are more than 20,000 kilometers of state roads and 50,000 kilometers of provincial roads over which motor-buses are running. And whereas there was not a single air route in those days, modern stream-lined planes are now flying over more than 10,000 kilometers of air lines.

Great progress has been made also in every field of industry and particularly in the manufacturing industries. The total capital invested in manufacturing industry, which was Y363,000,000 by the end of 1935, had increased to Y487,000,000 by the end of 1936 and to Y653,000,000 by the end of 1937. Should a traveller who knew the Manchuria of ten years ago happen to visit Mukden, Fushun, Anshan and Dairen to-day, he would be astonished to see row after row of huge plants standing on what was once vacant ground.

Rapid strides are being made, too, in the mining industry. At the end of 1935, the amount of capital invested in mining stood at Y398,000,000; it had advanced to Y400,000,000 by the end of 1936, and in the course of 1937 jumped to Y800,000,000. This increase is after all only a reflection of the increase in industry in general. Thus the total of invested industrial capital, which was Y707,000,000 at the end of 1931, had grown to Y1,260,000,000 by the end of 1935, to Y1,420,000,000 in 1936 and to Y2,233,000,000 in 1937.

With 90 per cent of the population said to be engaged in farming, agriculture is of particular importance in Manchoukuo. Following the establishment of the new State, the Government has done its utmost to develop the agricultural resources of the country. The total amount invested in agriculture swelled from about Y120,000,000 in 1935 to Y300,000,000 by the end of 1937, while the value of crops throughout the country has increased annually. In 1934, the total yield of soya beans was 3,400,000 tons, of other beans 300,000 tons, of kaoliang 3,500,000 tons and of millet 2,000,000 tons, and the grand total for all agricultural produce came to something like 12,780,000 tons. This total in 1938 had mounted to 17,940,000 tons, including 4,600,000 tons of soya beans, 360,000 tons of other beans, 4,060,000 tons of kaoliang and 3,130,000 tons of millet. Further increases, moreover, are still being recorded.

In Manchoukuo at present, three large-scale State plans are in active operation. These are the industrial five-year plan, the plan for economic construction in the northern border areas and the plan for co-operation with Japan on the question of emigration.

The Manchoukuo five-year plan, which was launched in 1937 at an estimated cost of Y2,580,000,000, aimed first at an annual output of 2,530,000 tons of iron, 25,500,000 tons of coal and 1,400,000 kilowatts of electric power. In the following year, however, the plan was enlarged to cost Y6,000,000,000 with ultimate production set at 5,000,000 tons of iron, 35,000,000 tons of coal and 2,500,000 kilowatts of electric power. It is now being faithfully carried out on this expanded basis and will, together with the program for a corresponding increase in agricultural production, probably be completed on schedule, thus conferring immense benefits on the people of Manchoukuo.

The plan for the economic construction in the northern border areas was announced in May, 1939. The budget for this project is Y1,000,000,000 to be used over a period of three years to adjust, renovate, and expand transportation, communication and air facilities in the northern provinces, to provide a supply of electricity and water, to plan cities and towns, to conserve and increase labor power, to undertake acquisition of materials, build up air defences and provide hygienic and clinical facilities for the people. It is with pleasurable anticipation that we are looking forward to the improvements that will have taken place in the northern border areas by the end of 1942, when the plan will be completed.

The aim of the immigration program is to have efficient farmers from Japan form a constructive nucleus in the population of Manchoukuo, and at the same time provide a volunteer reserve force for the defence of the joint Manchoukuo-Japan frontier. For this purpose, within the twenty years between 1937 and 1957, 1,000,000 Japanese farming families representing a total of 5,000,000 migrants, will be settled in Manchoukuo. The plan has the enthusiastic support of the Hsingking Government, which is supporting it in every possible way.

Thus the colossal Japanese experiment of Manchoukuo is succeeding in every respect. The development of Manchoukuo is a labor of love for Japan, the results of which are likely to amaze the next generation. In carrying out this labor of love, Japan has never for one moment harbored any imperialistic designs. She is convinced that this task on which she has expended tremendous amounts of money, materials and labor, cannot be a failure; that it will continue to give to the people of Manchoukuo such security and happiness as they never dared to hope for under the old régime.

The short-sighted people who compare conditions in Manchoukuo, after only eight years of endeavor, with conditions in their own highly developed capitalistic countries and seize on the differences revealed as proof of the precarious future of the new State, merely make us smile. In the not so distant future, when the great experiment is completed and recognized as successful by the world, the new order will be vindicated. It is my earnest hope that the peoples of the world will watch Manchoukuo grow from what it was in 1932, and so learn of one way in which a contribution, has been made to world peace. I can think of no greater reward to Japan for the sacrifices she has made than this.

"Eastern Asia" Makes Its Bow

Refreshingly attractive and novel in many of its details is a new publication bearing the title "Eastern Asia," which has just made its appearance. It is the latest, and in many respects the most ambitious effort in the publishing field that has been launched under sponsorship of The South Manchuria Railway Company.

The high artistic quality of the new journal is one of its outstanding features, and this is true both in text and in the pages of the advertising sections. The new magazine printed on art paper with a lavish use of color has a typographical distinction of its own. Especially noteworthy is the highly original manner in which many of the advertisements are presented.

It is set forth in an announcement that "Eastern Asia" has been brought out in response to a general demand for such a publication, and the announcement adds pertinently, "Armed conflicts have focussed attention on this part of the world. Eastern Asia has made the headlines only to become a byword for controversy and misunderstanding . . . A troubled world has long been served too many inspired explanations, has developed mental indigestion on a diet of highly seasoned propaganda. There is a growing demand for uncolored presentation of basic forces in Eastern Asia that give life and character to the absorbing drama of populations and cultures. This is the demand 'Eastern Asia' shall strive to satisfy."

Outstanding contributions in the initial issue of the publication are: "Manchuria: Racial Crossroads" by Charles Nelson Spinks; "Spring in Manchuria" by Minoru Taguchi; "Barga and Its Inhabitants" by Timothy O'Neill-Lane; "Two Chaste Widows" by L. C. Arlington; "Jehol's Cultural Heritage" by Hiroshi Kondo; "Fushun: Mining Metropolis" by Horace M. Masuda; "Nanking" by Zoe Kincaid and "Canton Sketches" by Tadao Kiyota.

The Dutch East Indies Adrift

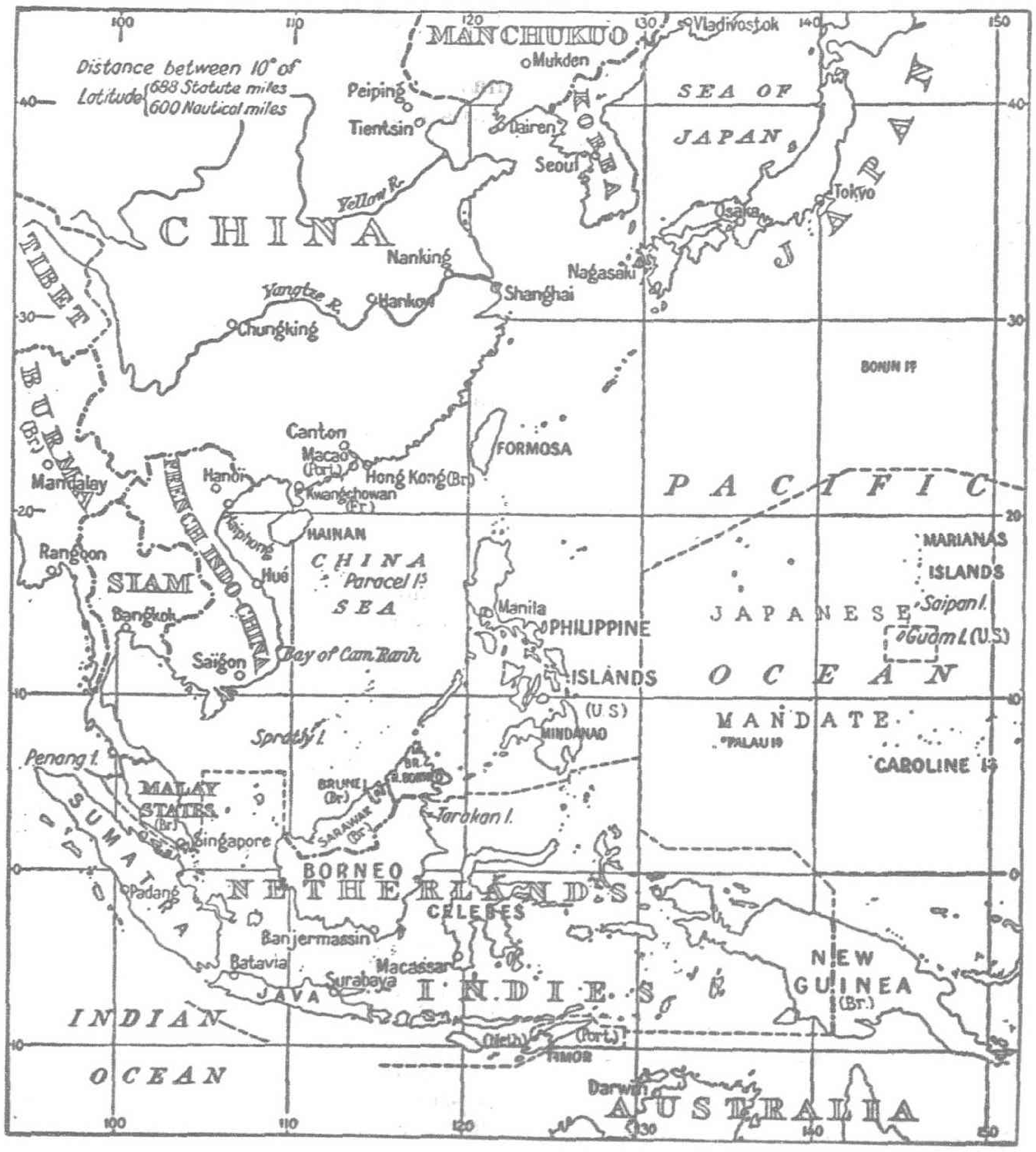
By RUPERT EMERSON

(Foreign Affairs)

The German invasion of Holland and the flight of Queen Wilhelmina's Government have thrown the Dutch East Indies largely on their own devices. Indeed, as these lines are written there are indications that the center of Dutch economic and financial life is being transferred to the Indies. For instance, leading Netherlands banks and shipping companies are reported to have removed their headquarters to Batavia. Likewise in the political sphere, the Indies are becoming the center of Dutch power. The Governor-General, Jonkheer Tjarda van Starkenborgh Stachouwer, has been empowered to act on his own authority, if necessary. The question therefore arises as to whether the East Indies will be able to survive as a Dutch possession. The answer to this question depends on such important factors as the economic and strategic value of the islands, the state of their defenses, and the policy which the United States would adopt towards any aggression against them.

On April 16, 1940, the Indies found, to their dismay, that they had become the object of those assurances of good will and disinterestedness which have come to be the first harbingers of imminent " protection " and destruction. On that day, Mr. Arita, the Foreign Minister of Japan, stated in the veiled but significant language of diplomacy that because of economic and other considerations " the Japanese Government cannot but be deeply concerned over any development accompanying the aggravation of the war in Europe that may affect the *status quo* of the Netherlands East Indies." This declaration came two months after Japan's denunciation of her arbitration treaty with The Netherlands, an act which Tokyo officially described as having no political importance, being merely a routine gesture preparatory to the negotiation of a new treaty. To Mr. Arita's statement, the American Secretary of State replied on the following day (April 17) that " intervention in the domestic affairs of the Netherlands Indies or any alteration of their *status quo* by other than peaceful processes would be prejudicial to the cause of stability, peace, and security not only in the region of the Netherlands Indies but in the entire Pacific area." The German invasion of The Netherlands early in May immediately brought forth from Mr. Arita a further assertion that Japan would not permit the Indies to change hands. Another official declaration was made in Washington reiterating the statement of April 17, and the American battle fleet was kept in Hawaii for "further tactical exercises."

Economically, strategically and politically the Netherlands Indies occupy a position of striking importance. The bare figures are in themselves impressive. With a land area of 734,000 square miles, the islands are some five times as large as Japan proper. They stretch, as Mr. Hull pointed out, " for a distance of approximately 3,200 miles east and west astride of the Equator, from the Indian Ocean on the west far into the Pacific Ocean on the east." At the last census (1930) the rapidly growing population totalled nearly 61,000,000 ; at present 70,000,000 would be more nearly correct. About two-thirds of this number is crowded into Java, though that island accounts for little more than one-fifteenth of the Indies' total area. The outer islands are relatively underpopulated and undeveloped except for occasional tracts such as the great rubber and tobacco region on the east coast of Sumatra. The mass of the people are of the Malay race and predominantly Mohammedan in religion ; but there are 1,233,000 Chinese and 240,000 persons in the official category of " European," which includes Americans, Japanese and a large proportion of Hollanders of mixed blood. The Japanese and Formosans in 1930 numbered just over 7,000, and the more recent migration figures indicate no marked increase. The number of Germans appears to be slightly under 7,000 ; late reports from Batavia indicate that all of them over sixteen have been interned.



Holland's East Indian empire constitutes the richest colonial plum in the world. It produces rubber, tin, petroleum, sugar, coffee, tea, tobacco, copra, palm oil and a host of other commodities, agricultural and mineral. Contrary to popular belief, most of the world's colonial areas are not great producers of essential raw materials ; the Indies, however, are an exception, although even they lack certain types of coal as well as iron and cotton. Until the impact of the depression became seriously felt, the Indies concentrated almost exclusively upon the production of raw materials and foodstuffs for export, as well as of certain foodstuffs (notably rice) for local consumption ; only to a limited degree were raw materials given a preliminary processing. The crushing effect of the depression on the islands can be seen in the catastrophic decline in the value of their exports from 1,488,000,000 guilders in 1929 to 493,000,000 in 1933 (by 1939 the figure had risen to 740,000,000). Of late there has been a marked swing in the direction of a planned industrialization in order to relieve unemployment, raise living standards and reduce the Indies' dependence on the world's industrial markets, thereby eliminating some of the causes for economic instability in the islands. Plans already being carried out include the creation of a chemical industry and the construction of plants for manufacturing aluminum, for melting scrap iron and for the production of aviation gasoline ; in addition, many smaller native and local industries are being encouraged.

The United States is the world's largest consumer of rubber and tin; it also holds considerable investments in the islands, particularly in rubber plantations and in oil. We cannot, therefore, be indifferent to the fate of the Indies (Incidentally, the neighboring territory of British Malaya is the world's largest single producer of rubber and tin, and any change in the status of the Dutch islands must inevitably have drastic repercussions on Malayan economy). The total direct American purchases in the Indies in 1938 came to $68,800,000 and in 1939 to $93,000,000; but it is very difficult to assess our actual dependence on East Indian supplies because of the large quantities which are transhipped to us via European and Malayan ports. In 1939 the Dutch islands produced 372,000 tons of rubber (35 per cent of the world total) as against 376,000 tons for Malaya, and 31,280 long tons of tin (17 per cent of the world total). The United States needs large quantities of tin and rubber, not only for its normal peacetime industries such as automobile manufacturing, but for its present greatly expanded defense preparations. At least nine-tenths of the rubber and tin we consume comes from the Indies and the nearby British territories. Another important American import from the Indies is quinine, of which the Dutch produce 90 per cent of the world's supply.

Neither Britain nor France depends very much upon the products of the Dutch Indies since their own colonial empires provide for most of their needs. Although in the statistics the British Empire showed as the destination of one-third of the Indies' total exports in 1938, approximately half of this figure represented goods sent to Singapore for distribution to other countries, including Japan and the United States. Great Britain and Eire took about five per cent of the exports of the islands, and Australia, whose connections with the Indies have in recent years become increasingly important, accounted for over four per cent. These figures do not, however, adequately reflect the close collaboration that has grown up between the British and the Dutch Empires in the East. It is, in fact, scarcely too much to say that since 1816, when the British returned Java to Holland, the Indies have depended for their protection primarily upon the British Navy. The British have also invested heavily in the islands; for instance, the Royal Dutch Shell has sunk a large amount of capital in the oil fields there. Territorially, too, the connections are close; many small Dutch islands are within sight of Singapore with its great naval base, and the whole northern part of Borneo is in British hands. Australia has a vital strategic interest in the fate of the Indies in general, and a particular interest in New Guinea, of which it controls the eastern half. One of the maxims of Australian foreign policy is that no aggressive Power must be allowed to gain a foothold on New Guinea. The Dutch are now engaged in hastily developing their half of the island in order to forestall outside encroachments.

In 1938, Germany's purchases in the East Indies amounted to 23,725,000 guilders, or 3.62 per cent of the island's total exports (The purchases of France amounted to 11,200,000 guilders). Germany has found the Indies a valuable source of rubber, copra, fibers and other tropical produce; and a considerable number of Germans have entered not only into the economic life of the islands but also into the Dutch administrative and military services.

Japan's interest in Netherlands India is naturally very great. Besides being a major consumer of its rubber and tin, she has a peculiarly vital concern in its growing petroleum production. Since no detailed Japanese figures as to either petroleum or mineral imports have been published since July 1937, and since Dutch export figures are not very relevant because of the large transhipments made through Singapore, it is impossible to estimate with any precision the extent of Japan's reliance on East Indian oil. It is obvious, however, that in case Japan should be cut off from American and British supplies, the wells in the nearby Indies would prove invaluable to her. The Indies stand fifth among the world's petroleum producers. Their 1939 output was 61,580,000 barrels, the largest in their history. The principal oil-producing region is on the east coast of Borneo, although the production of this field has been declining in recent years while that of southern Sumatra has been growing. According to recent reports, the new wells being bored by the Netherlands New Guinea Petroleum Company, in which both American and British capital is represented, have not yielded promising results. It is generally believed that the producing oil wells have been mined and would be promptly destroyed in case of a Japanese attack. The German experience in Rumania during the World War appears to indicate that this would impede Japanese utilization of the wells for a considerable, and perhaps crucial, period. New refining plants for the production of aviation gasoline are just coming into operation; the first one, near Palembang in Sumatra, began producing on March 2.

As a market the Indies are less important than as a source of raw materials, primarily because of the very low purchasing power of the mass of the people. However, for Japan's low-cost producers of cheap textiles and other commodities they offer attractive inducements in a world of shrinking and increasingly protected markets. A few years ago the Japanese share in the imports of the Indies skyrocketed upwards at the expense largely of Dutch and British importers; but this trend was checked abruptly by the imposition of tariffs and quotas primarily aimed at Japan. More recently the internal strains developed in Japan by the "China incident" have seriously impaired her ability to compete in the islands. The Japanese doubtless feel that Holland has unfairly deprived them of a market which they regard as an integral part of that Far Eastern economy in which they believe themselves to be the major partners. The Dutch, on the other hand, complain that the failure of Japanese purchases in the Indies to keep pace with the flood of Japanese exports to them has been one of the chief causes for the disequilibrium in the islands' economy.

In 1939, Japan sold to the Indies goods worth 85,108,000 guilders, while she bought from them goods valued at only 24,788,000 guilders. Of Japan's total exports in 1939 only 3.9 per cent went to the Dutch possessions, and of her total imports only 3.3 per cent came from them directly. The Japanese Government has manifested its determination to continue drawing on the raw materials of the East Indies in the same proportions as before Holland was invaded. Both the Dutch and British Governments have assured Tokyo that they will not interfere with Japanese trade in the Indies.

The Japanese authorities have at no time given any overt indication of a desire to assume political control over the Dutch islands, although there are a number of unofficial statements which point in that direction. They have, however, regularly expressed their deep interest in strengthening economic ties. Japan's Foreign Minister declared to the Diet early this year that "With regard to the South Seas regions, the Japanese Government are desirous of maintaining with them a relationship of co-existence and co-prosperity through economic co-operation and collaboration in the development of natural resources. We intend to put forth every effort along this line toward enhancing the existing close relation between Japan and those regions." The Dutch, for their part, have shown themselves eager to maintain friendly relations with Japan and to avoid any gestures which might be interpreted as hostile. They have come to find, however, that Japan's ideas as to what constitutes "co-operation and collaboration" overreach the limits of acceptable friendship. This has been especially obvious in Japan's efforts to secure opportunities for settlement and exploitation in New Guinea, which lies less than 500 miles from Japanese mandated islands. For many years Dutch New Guinea has been rife with reports of Japanese espionage, of Japanese fishing vessels far from legitimate fishing grounds, and of Japanese plantations with excellent sites for gun emplacements and landing fields.

Strategically and politically the Indies are extremely important because of the commanding position which they occupy at the crossroads of sea and air routes between Europe, the Far East and Australasia. For the British Empire, and for Australia and New Zealand in particular, it is of the utmost importance that these islands remain in friendly hands. Were Netherlands India to pass to a hostile Power, Britain would find it very difficult to retain Singapore and Hongkong and to maintain free communications with her Pacific Dominions and with China. Much the same can be said for France in connection with Indo-China and her Pacific islands. As for the United States, it is concerned in several ways with the political fate of the East Indies. There is our interest in maintaining the balance of power in the Pacific. There is also our interest in keeping open the sources from which we obtain much of our rubber and tin. Above all, there is our interest in the Philippines. Manila may be some 1,800 miles by air from Batavia, but the Dutch islands north-east of Borneo are almost within sight of Mindanao. The Japanese now control all the islands to the east of the Philippines (except Guam); Formosa has been theirs for nearly half a century; they are said to be fortifying the island of Hainan; and they are now occupying the Spratly Islands in the China Sea. If the Dutch East Indies should pass into Japanese hands—and with them perhaps the British possessions on the north coast of Borneo—the Philippines would be completely surrounded.

From an economic point of view, the United States might not in the long run lose heavily from a Japanese occupation of the East Indies. Except for petroleum Japan could absorb only a fraction of the island's vast production, which would still have to be disposed of on the world market—where the United States would remain by far the best and most available customer. Control over these supplies would, however, give Japan a strong economic and political weapon for compelling concessions from the United States, and in the short run this weapon might prove of great importance. Despite our ambitious projects for stock-piling and our barter agreement with Great Britain, we have as yet accumulated very limited reserves of either rubber or tin. It is estimated that the present supplies of both commodities in this country would not last for more than three or four months *at the normal rate of consumption.* The extent of our anxieties in this direction is indicated by the fact that imports of rubber since the beginning of December 1939 have been the heaviest in history. In case the United States should become involved in the war, we would doubtless resort, as in the days of the Stevenson restriction scheme, to an extensive use of scrap rubber. There are also possibilities for making synthetic rubber in the United States and for increasing natural rubber production under American auspices in Central and South America. But neither of these sources has yet been developed to a point where it could fill immediate and pressing needs. In the case of tin, we could obtain a large part of what we need from Bolivia.

Turning to the question of defense, it must be admitted at the outset that for various reasons, including the rapidly changing techniques of warfare, only a very tentative estimate is possible. Even the strength of the Japanese Navy is a matter of surmise, though there is no doubt that Japan has a large preponderance over any other Power in Far Eastern waters. The serious plight of Britain and France offers little hope that any substantial part of their naval or air forces could come to the aid of the Dutch islands. Presumably, neither the British or the French have any capital ships in the Far East at the present time. Just prior to the outbreak of the European war, the British Admiralty reported four of its cruisers in Chinese waters, with a fifth expected, and three more cruisers on the East Indies Station; to this must be added the six Australian cruisers and the two of New Zealand. Only the American Navy remains as a possible challenge to Japan, and it has been accepted by American naval opinion that operations in waters relatively close to the Japanese bases and shielded in part by the Japanese mandated islands would be extremely difficult and hazardous. The fortifications and bases of the Philippines and Guam are quite inadequate for the main American fleet, which would therefore have to base on Pearl Harbor, some 7,000 miles from Batavia.

The scanty but mobile defense forces of the Indies themselves could cause an attacking force great annoyance but could probably not put up resistance for any considerable time. The Dutch have been keenly aware of their exposed position in the Indies ever since Japan's invasion of Manchuria; yet they appear to have taken no very substantial steps to increase their defense forces in the islands. The army is estimated to number 50,000 (representing roughly a ratio of four natives to one European), although somewhat larger reserve forces are undoubtedly available. According to late reports, the Dutch Navy in the Indies consists of two cruisers of 7,000 tons, one of 6,000 tons, two smaller ones of 3,500 tons, twelve destroyers, eighteen submarines and a number of light auxiliary vessels. In recent years the Dutch have built up a fleet of seaplanes, many of them purchased in the United States; used as a scouting and bombing force these planes would prove invaluable in holding the narrow straits against invasion. It must, however, be kept in mind that the islands are scattered over a vast area and that the Japanese would therefore find no great difficulty in landing on such outlying islands as Borneo or New Guinea. Against this possibility must be balanced the fact that the distances from Japan to the Indies are great—from Yokohama to Borneo is some 2,400 miles—and that Japanese shipping is already heavily occupied in keeping essential supplies moving to Japan and to the Japanese-occupied parts of China. For Japan to strike far to the south would be to open herself, if not to war with the United States, at least to the sharp curtailment of her vital trade with North America and with the British and French Empires. And, of course, she would be exposing her flank to Soviet pressure, exerted either indirectly through Nationalist China or directly on Manchoukuo. As these lines are written, there are reports that Japan is trying to extricate herself as gracefully as possible from China and to reach an understanding with the totalitarian Powers with the object of exploiting to the full the present dire straits of the Western Powers. Should these reports turn out to be true, the situation of the Dutch East Indies would indeed become precarious.

What the attitude of the native peoples in the Indies would be in face of a Japanese attack is difficult to say. The nationalist movement is strong and no great love is lost for the Dutch rulers. However, relations between the nationalist leaders and Japan have not, it appears, been close. Japanese imperialism is something the East Indians have no desire to experience. Yet on the other hand, they also lose no love for the Chinese, who control much of the islands' economic life. The East Indies are hence watching the progress of the present war in China with mixed emotions. Some of them feel that a Chinese victory, resulting in a much strengthened and unified China, would represent an even greater danger for the East Indies than a Japanese victory.

The O'Ryan Survey

COMPLETED this month was a far-reaching, comprehensive probe of economic conditions and trade possibilities in Japan, China and Manchoukuo, a survey that may have important repercussions in Far Eastern foreign trade. The survey was conducted by Major-General John F. O'Ryan (retired), prominent New York attorney, on behalf of the Japan Economic Federation of Tokyo.

The results of Major-General O'Ryan's investigations will not be known for some time. The American expert left Yokohama about the middle of this month for the United States. During the voyage, he will organize the material he and his assistants collected in innumerable interview with leading officials, businessmen and others on his tour.

Major-General O'Ryan was given every facility by the Japan Economic Federation to gather information. Facts, figures, opinions and first-hand observations made on the trip will be assembled into a comprehensive report. The party interviewed numerous foreign as well as Chinese and Japanese individuals.

Major-General O'Ryan, World War Commander of the New York National Guard Division, has made the survey in a private capacity for the Japan Economic Federation. At the time of his departure from New York, considerable significance had been put on an interview he had with President Roosevelt. It had been suggested that Mr. Roosevelt was greatly interested in the project with the possibility that the findings might influence America's Far East policy.

In Shanghai, however, Major-General O'Ryan discounted these reports, saying he had visited the President in a purely personal capacity since he knew Mr. Roosevelt intimately, and had been associated with him for many years through their mutual Democratic political background in New York State.

The survey, obviously, was instigated with the hope that an impartial report by a well-known and qualified American would stimulate Japanese-American trade, and perhaps encourage the investment of American capital in the Far East. Major-General O'Ryan made it clear that he is under no obligation to produce a report favorable to the Economic Federation. The sponsors desire that a thorough and unbiased report be made available to American traders and financiers who, although deprived by the war of

(Continued on page 296)

Portrait of Mr. Wang Ching-wei

By IPPEI FUKUDA

My appointment for an interview with Mr. Wang Ching-wei, Acting President of the Nanking Government, had been set at eleven o'clock on the morning of July 12, 1940. It was already close on twelve and there was no sight of the interpreter who was to take me to Mr. Wang's official residence and tide me over the tryst. It was impossible. In desperation, I told the desk clerk to ring up the tardy rascal. I said he could depart as far as I cared to from the usual diction of a hotel employee. The thermometer greeted the coming of the day by hitting 99 degrees in the shade when I got up. The spectacle of a solitary American in helmet standing right under an electric fan with sweat running in torrents down his massive face aggravated the heat and the anguish that had been tormenting me for an hour.

"The gentleman says," I was told by the clerk, "that you should have known that the Nanking leaders work, eat and sleep on Chinese time just as their rivals at Chungking do. That they do not recognize daylight saving or summer time as an institution of national policy. That you are fretting and raving for no good reason at all. The gentleman knows, he says, how to take care of you."

Mr. Wang Ching-wei, Chairman of the Central Executive Committee of the Orthodox Kuomintang and President of the Central Military Officers' Training Corps, as seen before the microphone

On our way, my dictatorial interpreter repeated the admonition that in China I should do well to do as Chinese do. "Impatience," he observed, "is a sure sign of inferiority complex here and you had better tuck it away from sight when you meet the Chinese leader."

The armed guards greeted us with a salute. Soon we were shown into a foreign style smoking room with a large portrait of Dr. Sun Yat-sen hanging on the wall. But for this silent reminder of the succession of ruthless assassinations, years of exile in foreign countries, bloody battles fought in North, Central and South China, and intrigues and counter-intrigues which have given a tragic accent to the Chinese Revolution so far, everything was quiet and homelike in the room where, mopping up welling moisture from our brows, we waited for the bearer of the torch of Revolution since the death of Dr. Sun Yat-sen in 1925.

The door opened quietly ushering in a handsome, clean-shaven man in Palm Beach suit and we rose to shake hands with Mr. Wang Ching-wei. In his book "Inside Asia," John Gunther says that in America the Chinese statesman would pass for a young man in his twenties. I meant to be more honest when I assured His Excellency: "In my home town, Tokyo, people would call you a liar if you tell them you are a day older than two-and-thirty." I further demanded to know if he had been tapping some secret fountain of eternal youth. The question had its origin in my unwillingness to embarrass our host by hauling up politics as I knew that, like the heat wave, protracted talks on treaties between his Government and ours were in full blast. However, Mr. Wang Ching-wei waved aside my attempt at pleasantries with a smile. I was not slow to take the cue from him: he was too busy for nonsense. Without further ado, therefore, we got down to politics with its inevitable whys and wheretos.

Throughout the interview which lasted for a good part of an hour, I was amazed to find him cool and collected, in the midst of riots of the sun and war. Here is a man, I thought, who has nerves of steel—a man who would really smile into the muzzle of an assassin's revolver. It must be frankly admitted that in comparison, General Chiang Kai-shek may be said to be secure in wealth, power and a sense of his personal safety at Chungking, his war-capital, as no assassin would even think of penetrating the cordons of his troops to make an attempt on his life, while the head of the Nanking Government is exposed to no small number of paid killers who prowl in the areas in which he has to move about.

A month after the interview the impressions are still vivid, and I find it all the more difficult to merge into one the two diametrically different pictures of the leader: the picture of a man with manners so gentle which to some may suggest a touch of femininity, a man who is obviously keenly alive to every finesse known to the best dressed man about town; and that of a man who is definitely one of the most fearless and determined fighters for revolution in the world, a dare-devil who, one night in 1910, sought to blow up the Tsing Dynasty by setting dynamite in the basement of the Prince Regent's palace in Peking.

A study of Mr. Wang's background, and of the background of the Chinese students of his period may help to explain the man Wang.

Believe it or not, Mr. Wang Ching-wei is fifty six-years old. He was born in the semi-tropical, overcrowded town of Canton in 1884. His father, a small shopkeeper with a passion for Chinese literature and philosophy, was well over sixty when he brought forth this tenth child by his second wife into a China disrupted by the progressive decay of the Tsing régime. Unlike their brothers in the north, the Manchus, the people of Canton are famed for their sharp wit, general alertness, and faith in progress. In many ways, Canton ranks high among the towns and cities of China. It has given birth to most of China's intellectuals among whom Dr. Sun Yat-sen, Father of the Chinese Revolution, and his protégé, Mr. Wang Ching-wei, are the most prominent. All the leading department stores in Shanghai owe their origin to the enterprising spirit of the Cantonese. The city has weathered many uprisings of its sons against reactionaries. That it was the first center in China to end the sadistic custom of binding women's feet speaks well for the progressive spirit of the birthplace of Mr. Wang.

His boyhood was nothing but a fight for a living. One can well imagine that he was born ambitious. The free school called Nature lavished its benefits on the child of the poor Cantonese merchant who was denied the advantages of expensive education. It seems that, deplorable as his early schooling was, the boy had an almost insatiable, irresistible thirst for books and knowledge. Many a waning afternoon, it is said, found the boy buried among them in library. And his father was a bit of a scholar himself who took pains to instruct his son in Chinese classics. That is about all we know of his boyhood.

Somehow, he managed to get a government scholarship which brought him to Japan in 1903, now a youth of nineteen with a precocious appetite for politics. Girl friends and sprees formed no part of his college life in Tokyo. Beside his schoolroom grind, he busied himself as an inordinately active member of the Tun Meng

Hui, a secret revolutionary society founded by Dr. Sun Yat-sen in Tokyo, which was destined to become in course of time the now famous Kuomintang. He was soon made chairman of its Executive Council and editor of the *Min Pao*, an organ of the body mainly devoted to stirring up a revolutionary fervor among the Chinese students in Japan. It was during his hectic days in Tokyo that he was torn between agitation against the Tsing Dynasty and glowing ideas of revolution, and his desire to obtain in Tokyo what he had missed in his hometown—a university education.

I entered Waseda only a few months after the extremely public-minded young man from Canton left Tokyo, or was deported, to be more exact. The Tsing rulers, sensing the highly dangerous potentialities of the propaganda campaign engaged in by these firebrands, had been protesting to the Japanese government for giving them shelter where, if left alone, they might hatch further mischief. After some hesitation, the Home Office is said to have intimated in polite words to Dr. Sun Yat-sen and his followers that it would ever be grateful if they were so good as to pack up and clear out promptly. Bidding Tokyo " sayonara " accordingly, Mr. Wang Ching-wei followed his chief to Annam in 1906. It is significant that the Three People's Principles, the well-known slogans of the Kuomintang party, were drafted and made public in Tokyo by Dr. Sun Yat-sen and his devoted aid, Mr. Wang.

I can recall quite vividly how the Chinese students shifted for themselves in those days in a country which had acquired a swollen head over its recent victory over China. There were about 20,000 of them in Tokyo alone. Most of them looked pitifully pale, thin and distraught. Perhaps our food did its part for raw fish and bean soup did not agree with the carnivorous race of the Asiatic continent. More probably, the profiteers who ran boarding houses mainly catering to the aliens fed them on left-overs. In any event, the Chinese students presented a picture of helplessness. We Japanese boys generally looked on them with as much indifference as they did on us. " China experts " who to-day insist on our knowing China and getting acquainted with Chinese people were either few or neglectful in those days. The language barrier added to the difficulties of the stranded Chinese who kept to themselves.

Had it not been for the " ronins " samurai without lords, life in the Island Empire would have been unbearable for them. " Ronins " in the Meiji era were not the self-seeking, raucous namesakes of these days: they were trustworthy good fellows, although they drank heavily, laughed loudly and sinned without remorse. Most of them had first-hand knowledge of China while some had roamed about and lived on the continent for so long that they openly confessed their weariness with the " boxed garden " sort of life in their own country. The cold calculating mind of a Western empire-builder was beyond the reach of those jovial braggadocios who, in their way, had a strong disapproval of any selfish designs on China on the part of any Power, East or West. In their vague way of thinking, those pioneers of the tribe of " ronins " felt confident they could pave the way for a vast, glorious future where Japanese and Chinese peoples were to live happily together, forgetting all their differences and time-old contempt for each other. And they stuck to this ideal. In truth, they had gone in for ronin-ism not so much as a means of livelihood, as is the case with some of their more recent heirs, but as an only avenue open to men who, in spite of their disabilities in many respects, wanted to do their bit for the great cause they believed in. Needless to say, they were not men of means. When hard put, they blackmailed bankers and fat politicians in order to secure funds for helping needy Chinese students or renting a house for the use of the Chinese revolutionary leaders as their hangout. Their whole-hearted friendship and support for Dr. Sun Yat-sen, Mr. Wang Ching-wei and thousands of others who came over to Japan to find a haven or study went far, I believe, towards endearing our country to the hearts of the revolutionists.

As may be seen from the objectives Dr. Sun Yat-sen had set before the members of the Tung Min Hui on the occasion of its initial meeting in Tokyo, the overthrow of the Tsing Dynasty and all forms of tyranny under the Manchus was their immediate aim. They were told by their leader to oust the Manchu régime then ensconced at Peking, to herald in a Republic for China, to co-operate with other nations for world peace, to bring about a closer relationship with Japan in particular, and to press for nationalization of land. Shortly afterward, the five-point platform of the party was officially proclaimed by Dr. Sun in its more concise form, the Three People's Principle.

In 1910, we see Mr. Wang Ching-wei now a hardened revolutionary, planting dynamite in the cellar of the Peking home of the Prince Regent under cover of night. The desperate attempt was aimed at their common enemy, the Tsing Dynasty. The young would-be assassin was caught red-handed before the fuse was lit. The death penalty which had first been decreed by the court at Peking was later mitigated into life imprisonment which, however, meant practically the same thing because of the horrible prison conditions in China in those chaotic days. But, however slight the difference in the court decision might have appeared to him, the upshot was that Mr. Wang Ching-wei made his escape from the prison thanks to his resourceful sweetheart of the same revolutionary faith, who knew how to drop a bankroll on the palm of the warden. Wang married the fair comrade two years after his escape. To-day, Madam Wang Ching-wei looks as amazingly youthful as her spouse. It was the magnetism of love which drew them together in matrimony as was the match between General Chiang Kai-shek and Miss Soong. The latter was also a " political marriage " prompted by a desire by both parties concerned to dovetail through betrothal the stupendous wealth of the Soong family with the dominant political power in possession of the soldier-statesman.

As a reporter of the *Asahi* chain of newspapers some years ago, I met General Chiang Kai-shek at Arima, a summer resort near Kobe. A stocky, bespectacled Chinese who turned out to be none other than Mr. T. V. Soong did most of the talking during the interview. He first disclaimed political significance in General Chiang's visit in Japan and added that the hero of China came to arrange the marriage with his sister. While he took us reporters into his confidence, his prospective brother-in-law, the hero of China, stood by as if he did not care so terribly much for the important disclosure. Nor did he strike us as the happiest man in the world under the felicitous circumstance. No wonder that General Chiang looked sullen and rather put out; his political circumstances at that very moment were one too rosy.

History shows that then and there he was in fact making plans, not so much for the wedding as for a comeback against Mr. Wang Ching-wei whose star had been in ascendancy over his. The paths of the two men have crossed and re-crossed in the wilderness of China's politics. At times, the rivals seemed to bury their hatchets and make up. But not once did they reach terms in complete agreement. Both are born politicians, it is true, but they were born under different stars. No political devices to bring them together as friends would be of avail. Their contact has been one of frustration and friction, and so will it be without end. It simply cannot be helped. That's all there is to it.

Eating his heart out behind the prison bars at Peking, Mr. Wang poured out in verse his despair, and longing for the only woman he loved. One can get, I am told, a collection of his poems translated in English at any Shanghai book shop. I do not know how good he is as a poet. Some of our great statesmen who fought tooth and nail for constitutional government for Japan during the early Meiji years courted the Muse much in the same way as Mr. Wang. I can recall how Prince Hirobumi Ito was wont to dash off one poem after another when he faced political situations rife with crises. There must be hundreds of his lyrical " masterpieces." Honest critics say they are bad. Perhaps those composed by the Acting President of the Nanking Government may not be so bad. But one has never read in the papers about General Chiang Kai-shek lost in poetry. My impression of the Chungking leader with his steely, ruthless eyes is that of a man whose one consuming ambition in life is to get things done in his own way. In contrast, Mr. Wang Ching-wei is no doubt infinitely more human. Any man who ponders over verse and is ready to stake his own life for an ideal cannot be anything else.

To Exploit Saghalien Mines

The Tohoku Development Company, after a detailed investigation of the so-called " sealed " coal mines in South Saghalien, has decided to set up a company for their development in the near future, says the *Hochi*.

Though these mines are so unprofitable that the Government some years ago ordered that they be sealed, the current shortage of coal has led to a revival of interest in their development.

Fast Diesel Railcars in Belgium

Among European railway administrations, that of the Belgian National Railways was among the first to take steps to accelerate passenger traffic. The necessity for improved and faster rail services in large measure in Belgium grew out of the great density of population, and this was true also in Holland. These improvements, first made on main lines, quickly spread to secondary lines. In achieving faster services over these railway systems the realization was kept in mind that the length of time spent on a railway journey depends not only on travelling speed but also, to a great extent, on the frequency of travelling possibilities offered to the passenger. Various problems related to the intense international through traffic in Belgium had to be considered in connection with domestic needs created by the many industrial and commercial centers of the country which require quick and frequent rail service, not only over main lines from the Capital, but also over all feeder lines.

In the earlier stages of the changes that have been brought about the Belgian National Railways introduced steam locomotives of modern design, electrified the Brussels-Antwerp line, and improved track and signalling equipment. At length the Belgian Administration replaced the steam trains with railcars powered with internal combustion engines specially designed for faster traffic and having improved starting acceleration, maximum speeds and special braking features. By increasing maximum speeds on main lines a characteristic Diesel railcar service was developed by which travelling times were remarkably reduced. As these changes were begun in Belgium early in the history of the fast railcar the rail services provided in Belgium in recent times disclose a high degree of progress. Out of Brussels the multi-coach Diesel railcars now provide exceedingly fast services on almost all the main lines. With the exception of the big international through trains and the electrified Brussels-Antwerp line, this express traffic is chiefly carried by triple railcars. In general, eight three-car Diesel-electric sets and six three-coach Diesel-hydraulic fast railcars are available. In addition, the stud of the Belgian National Railways comprise the following railcars operating the local and semi-express services: 21 bogie type railcars and six four-wheeled railcars of different makes with mechanical drive and three railcars with electric transmission. To these are being added a series of railcars under construction, most of which are of the four-wheeled type. There are also, however, eight-wheeled and two-coach railcars for secondary lines and for working the local and semi-express traffic on main lines. Some of these new vehicles already are in service. Fig. 1 shows the main lines in Belgium over which triple express railcars with Diesel engine drive are operating. Other railcar models are in service on the numerous secondary lines.

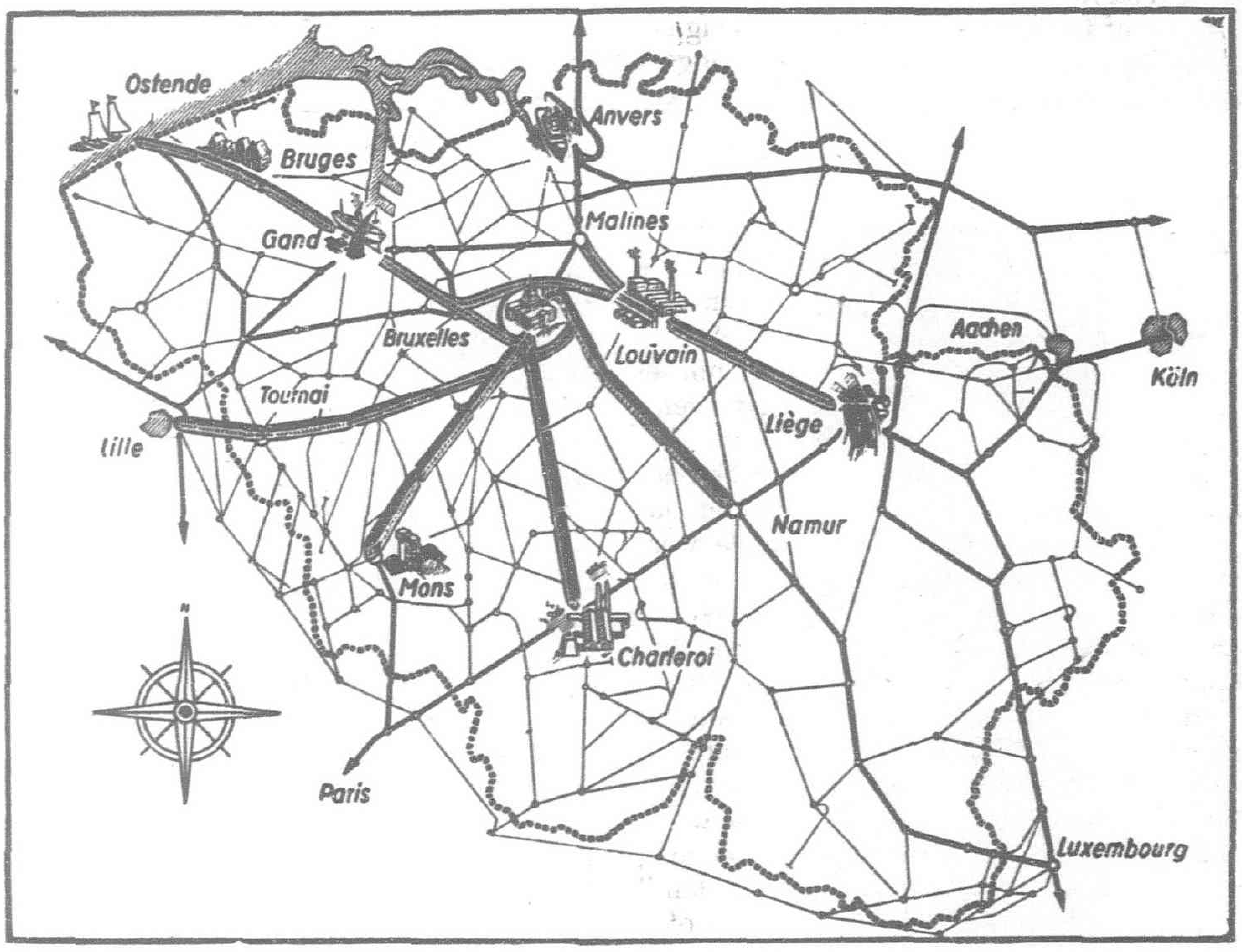


Fig. 1.—Railway map of Belgium

First Railcars in Local Services

It was in 1930 that the Administration of the Belgian National Railways inaugurated Diesel railcar service with three railcars imported from Germany. These were equipped with 150/175 b.h.p. six-cylinder Maybach Diesel engines and with the Maybach mechanical gear box. Mechanical parts had been built by the Waggonfabrik Wismar Aktiengesellschaft at Wismar. It is interesting to examine the total mileage of these first railcars. The average for the three railcars near the close of 1938 was no less than 751,980 km. (467,265 miles) and this performance had been given entirely in local traffic having but short distances between stops and with a permitted top speed of but 65 km.p.h. (40.4 miles per hour).

In consequence of excellent results obtained from the first three railcars the Belgian National Railways in 1932 placed an order with the Belgian coach builders, Ste. Ame La Brugeoise et Nicaise and Delcuve, for the construction of an additional fourteen railcars designed for service on secondary lines with a maximum speed of 80 km.p.h. (49.7 miles), See Fig. 2. As the original three railcars served as models for the new equipment, it followed that

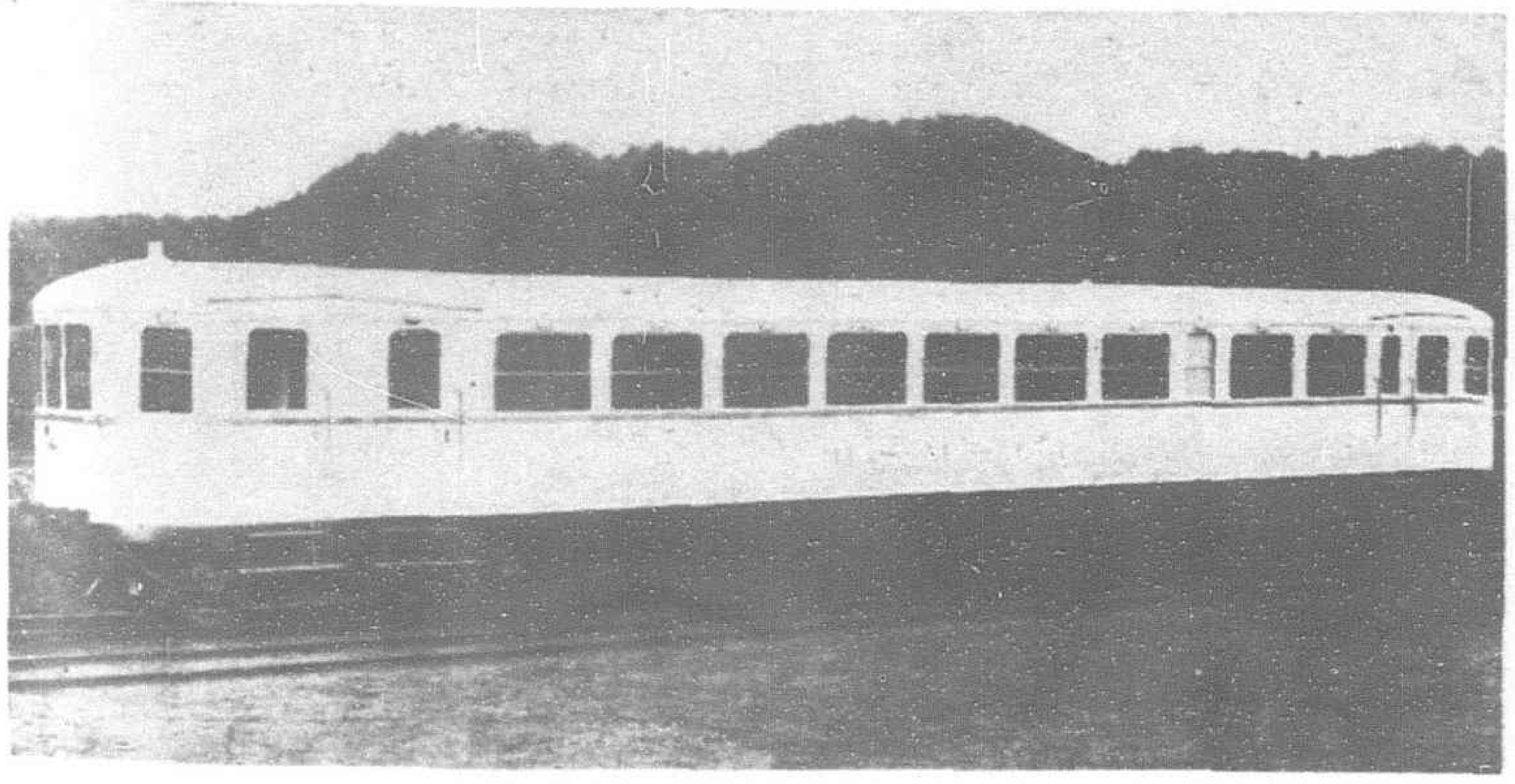


Fig. 2.—Exterior view of the 175 b.h.p. railcar

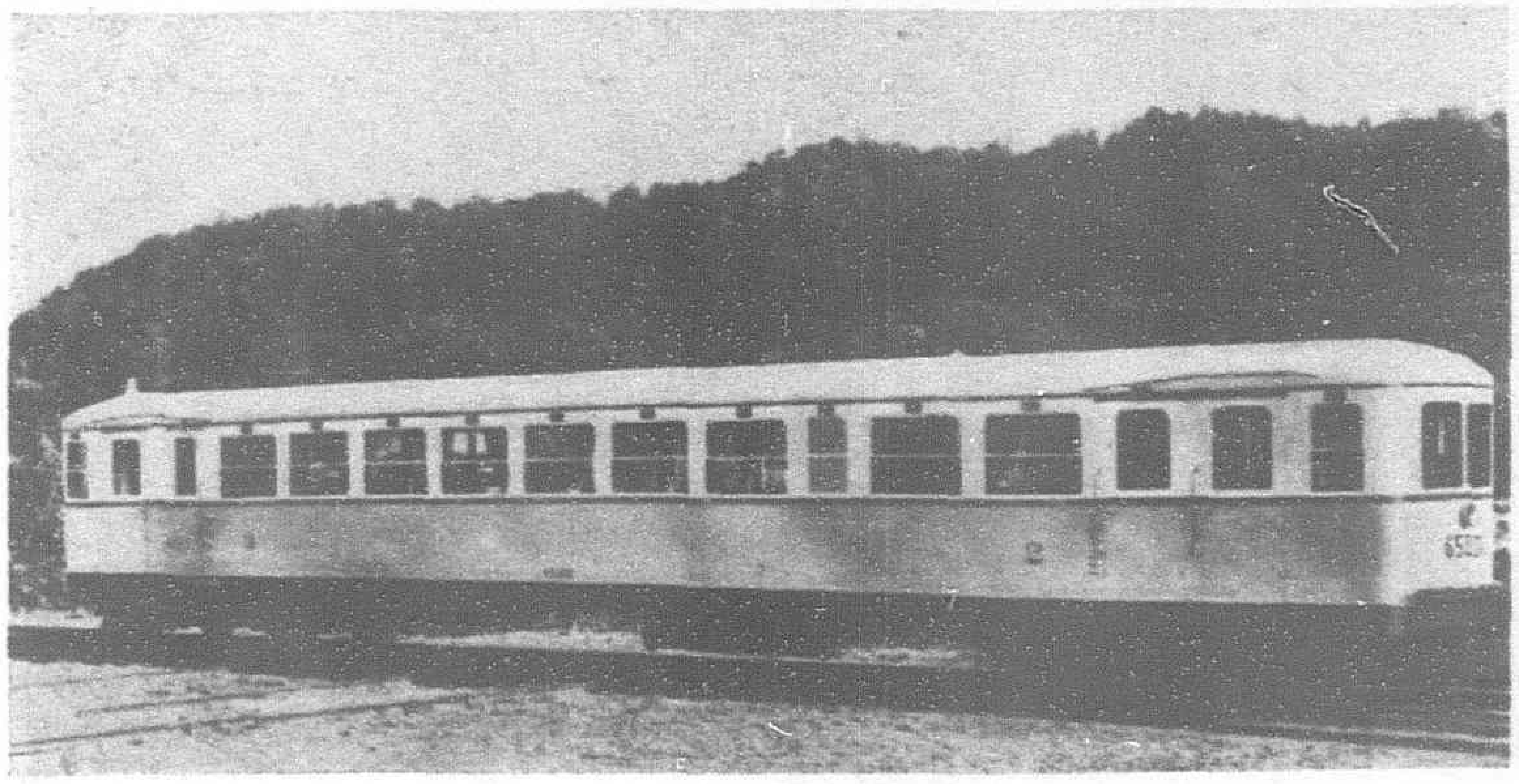


Fig. 3.—Exterior view of the 210 b.h.p. railcar

the fourteen new railcars were equipped with Maybach six-cylinder engines, powered to give 175 b.h.p. and with mechanical transmission by means of the Maybach gear box. At the end of 1938 these fourteen railcars had run an average mileage of 514,867 km. (319,928 miles) each in only local traffic covering short distances.

In 1933 two additional eight-wheeled railcars were acquired by the Belgian National Railways. Mechanically, in principle, these were similar to the earlier railcars, but a new feature was that the car bodies as well as the bogies were entirely welded. Also there were differences in the engine sets, for in these new railcars Maybach six-cylinder Diesel engines with airless injection replaced the compressor engines. Owing to this the new engines developed an output of 210 b.h.p. at 1,400 r.p.m.

The transmissions in the two railcars equipped with 210 b.h.p. engines differed. One included the Maybach gear box similar to those installed in the earlier four-axle cars, and the other vehicle was equipped with an electric transmission system, shown in Fig. 3.

The various railcar types mentioned proved definitely the suitability of the Diesel powered railcar for local and semi-express services on secondary lines. Therefore, the Belgian National Railways in subsequent years acquired additional four-wheeled and eight-wheeled railcars, most of which were equipped with mechanical gear boxes. In 1939 a considerable number of small four-wheeled railcars of the light structure type were being constructed for Belgian secondary lines.

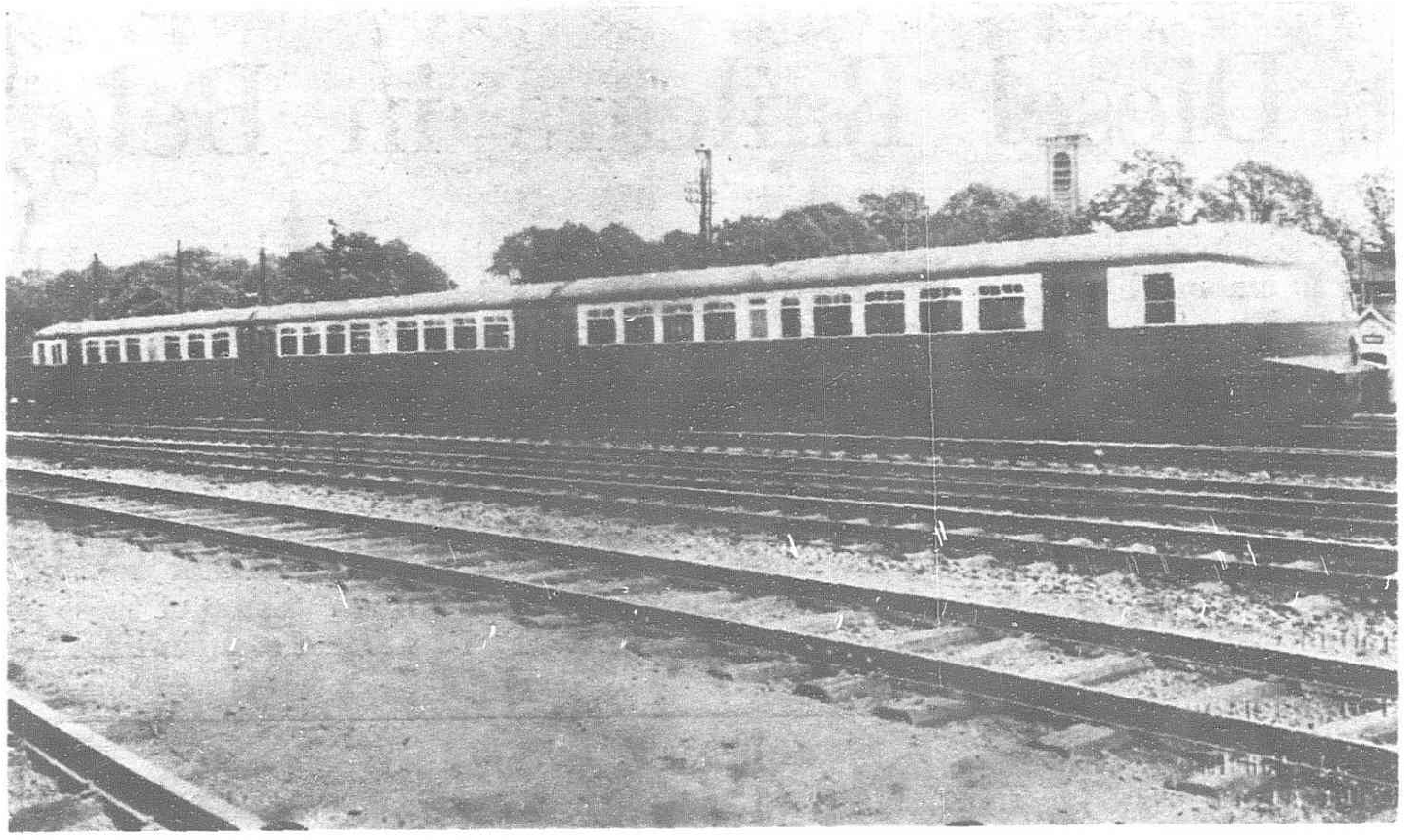


Fig. 5.—An 820 b.h.p. triple railcar

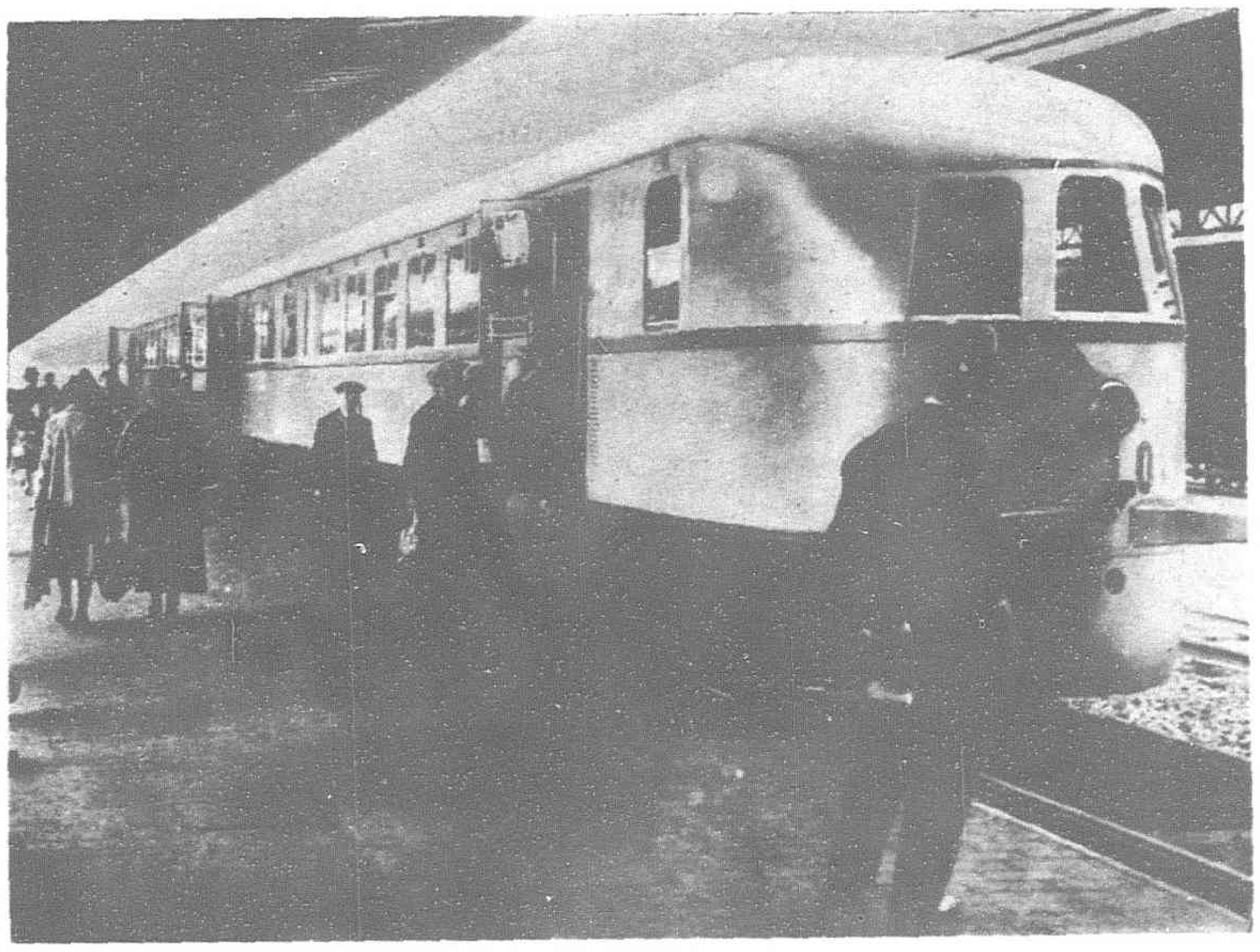


Fig. 4.—A 410 b.h.p. double railcar

The development in Belgium of the use of the Diesel powered railcar shows how steam locomotives in local services over the less frequented secondary lines gradually are being displaced by railcars. It appears, in fact, that only through use of railcars can services be accelerated over such lines economically or number of trains be increased.

Railcars for Express Services

At the same time that the fourteen 175 b.h.p. Diesel-powered railcars were being constructed, the coach builders Ste. Ame La Brugeoise et Nicaise and Delcuve designed the first multi-coach railcar of the Belgian National Railways. This was planned as a twin railcar.

The two car bodies of the twin railcar are united by means of an articulated bogie and have a fore-front or bow that offers as little air resistance as possible. In view of the circumstance that at higher speeds—and the maximum speed of the railcar is 130 km.p.h. (80.8 miles)—a considerable quantity of installed engine power must be employed to overcome the air resistance, special efforts were directed to gain excess power for acceleration of the vehicle by streamlining the car body. This principle, now universally applied to fast running railcars, was maintained in Belgium through the years of railcar development for all multi-coach express railcars. Therefore,

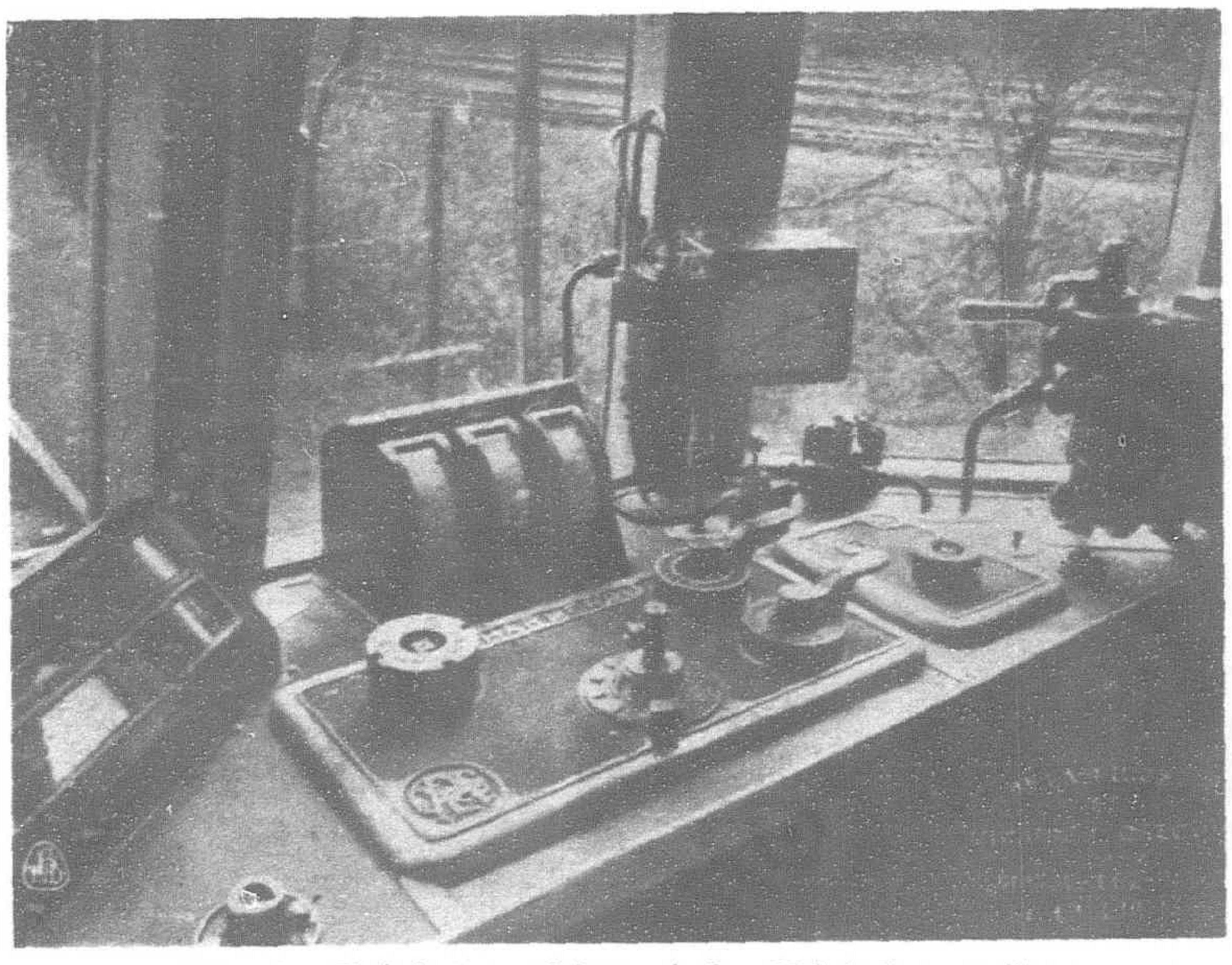


Fig. 6.—Driving position of the 820 b.h.p. railcar

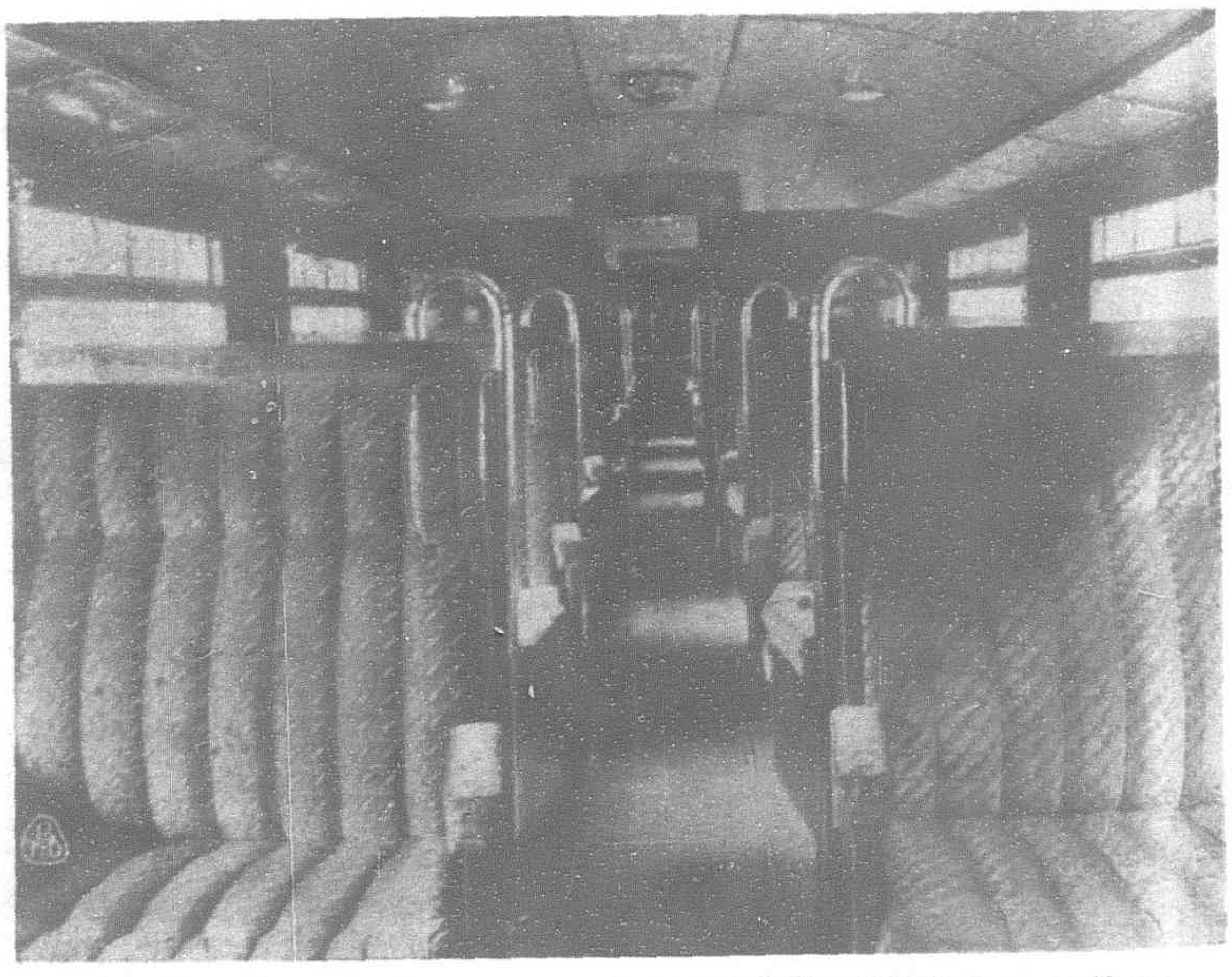


Fig. 7.—Second class compartment of the 820 b.h.p. railcar

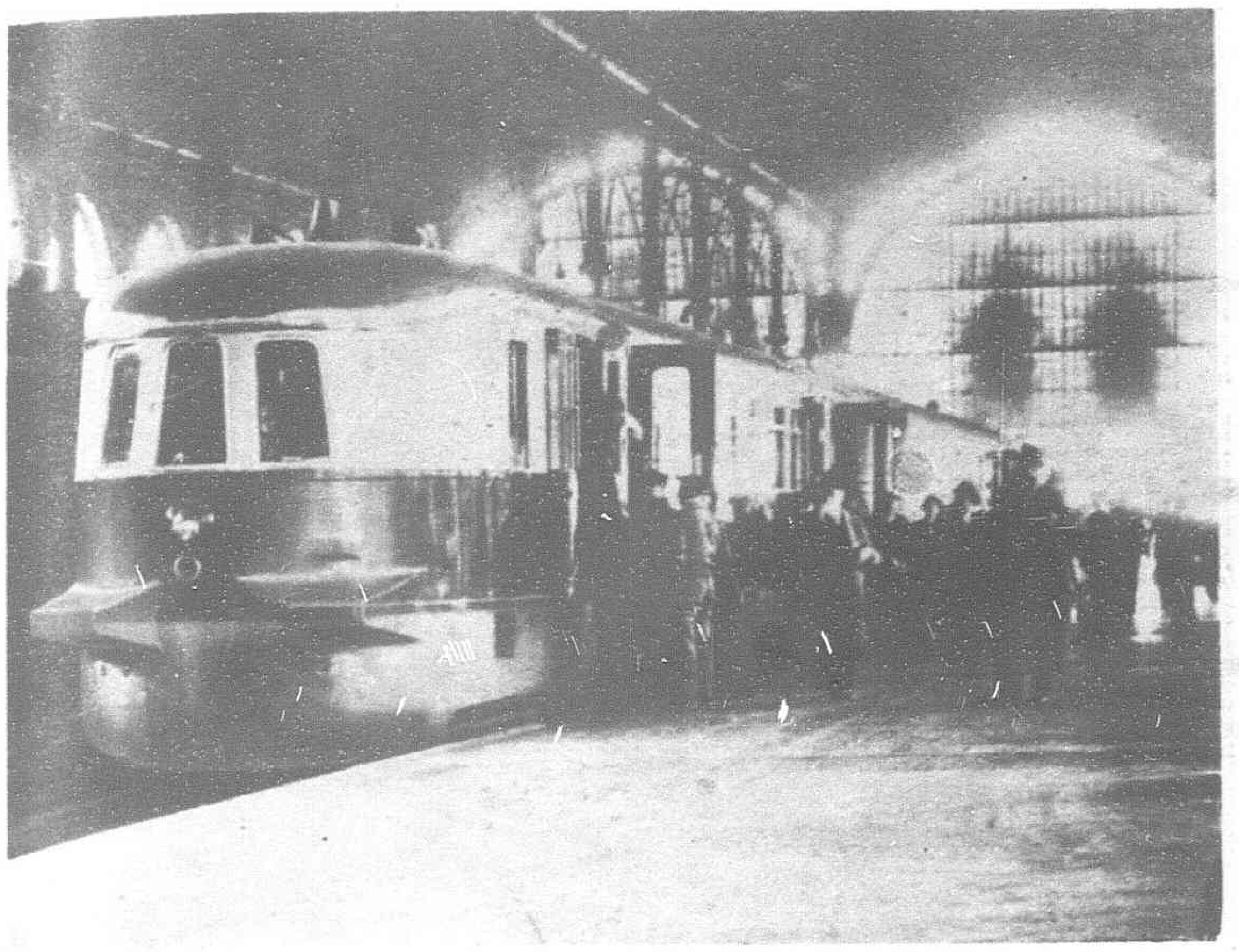


Fig. 9.—A 1,200 b.h.p. railcar at the Brussels Station

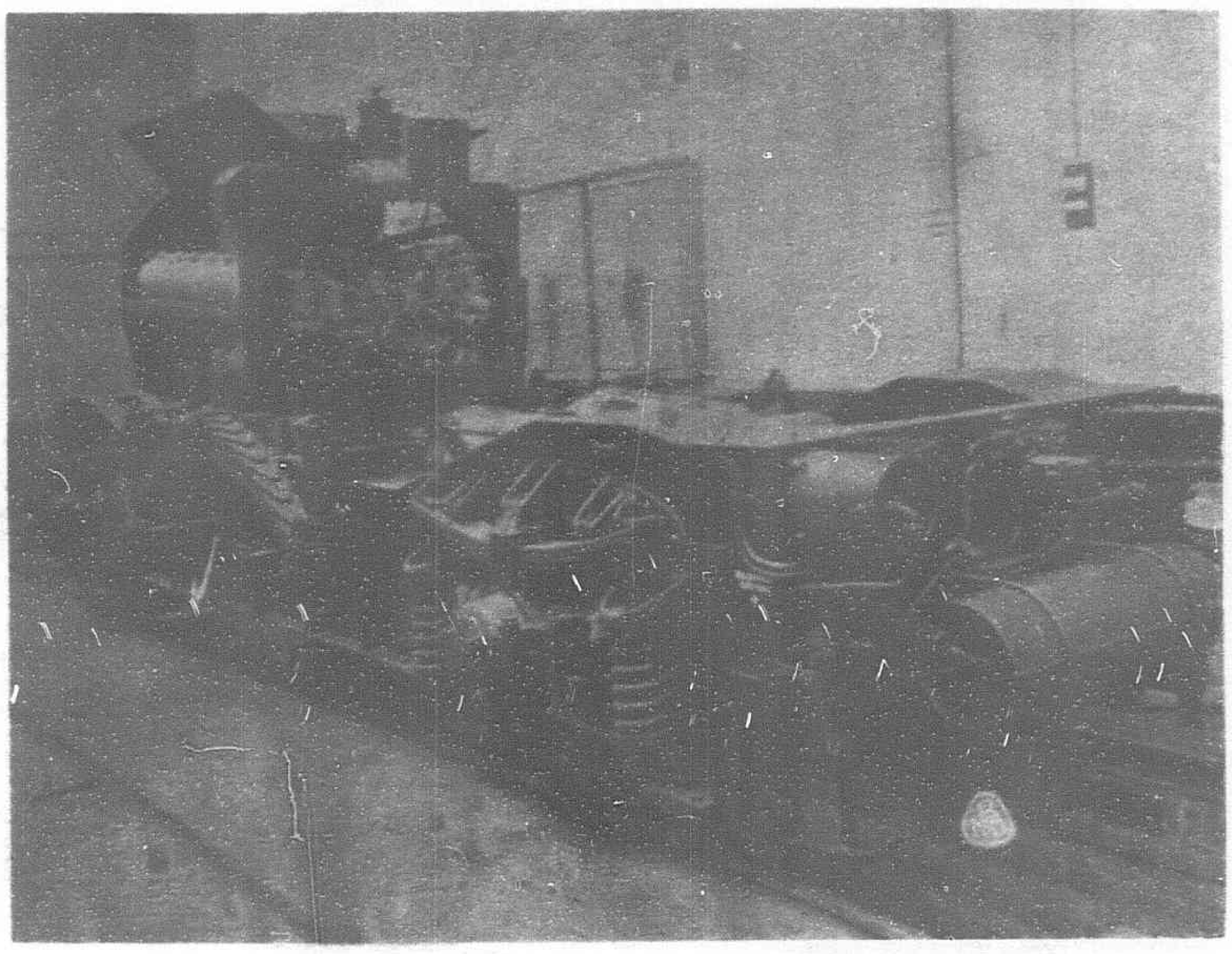


Fig. 10.—Power bogie of the 1,200 b.h.p. railcar

all these railcars are identical in the outer contours of car body and in the bow, as is to be seen in Fig. 4. Through the period of construction of the twin railcar electric transmission commonly was employed in the fast multi-coach railcars.

As excellent results had been attained with the four-axle railcars with Diesel engine mounted on the bogie, as regards noise damping and simple maintenance in service, the Diesel engine, together with main and auxiliary generators, again was installed on an end bogie of the twin railcar. The central articulated bogie carries the two electric traction motors and the second end bogie is a mere carrying one. As the multi-coach railcar requires higher motive power than a secondary line railcar, the Belgian National Railways adopted as power plant for the multi-coach railcars the high-speed 410 b.h.p. Maybach twelve-cylinder Diesel engine, then the only high-speed Diesel engine of this power range that had been fully tested in practical service.

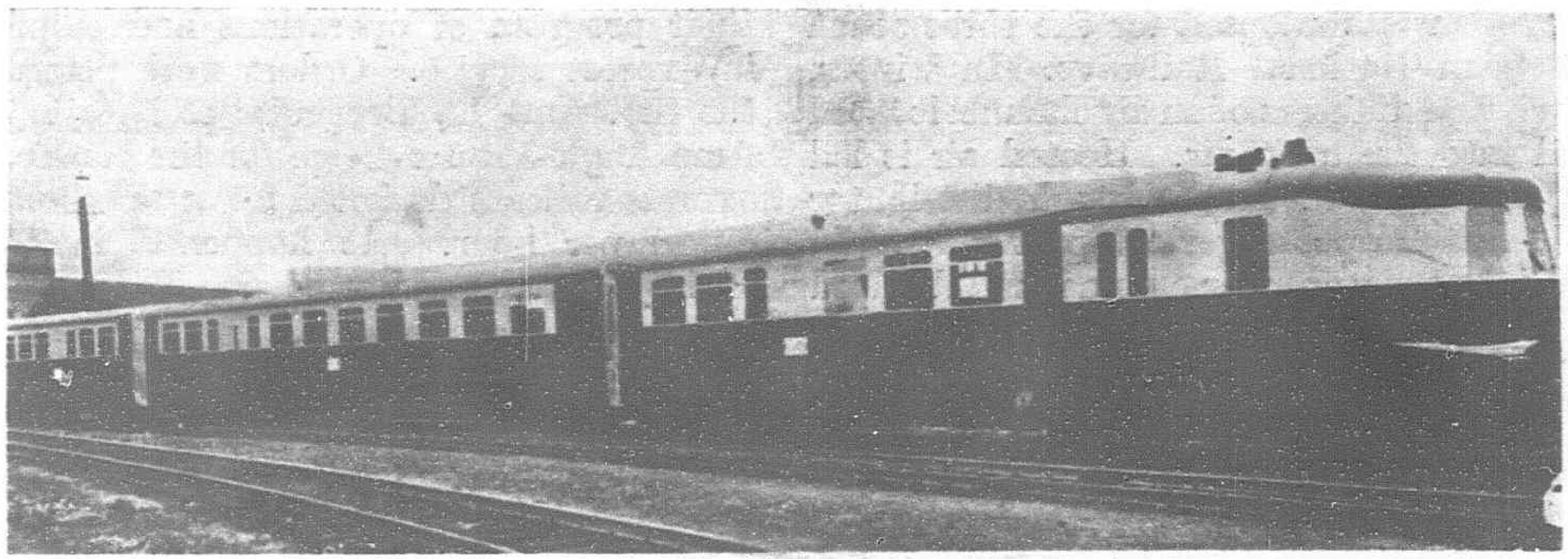


Fig. 8.—A 1,200 b.h.p. triple railcar

In 1934 the Belgian coach building industry received an order for the construction of eight triple railcars each equipped with two engine sets and electric transmission. The change from the twin railcar to the triple railcar shows how this type of vehicle was gaining in popularity with passengers, making it necessary to increase seating capacity of the new railcars.

As regards mechancial equipment the eight express railcars in principle were identical. Each railcar unit had four two-axle bogies, which is to say that the individual cars of the triple railcar unit are joined by articulated bogies. The two end bogies each carry a Diesel engine with the main and auxiliary generators and the central bogies each carry two electric traction motors, as shown in Figs. 5, 6 and 7.

Three of the triple express railcars built by Ste. Ame La Brugeoise et Nicaise and Delcuve were powered with 410/450 b.h.p. Maybach twelve-cylinder Diesel engines. They were put into service in 1936. The other five units were powered with three differing engine types. It is to be recorded that subsequently when an additional five railcars of

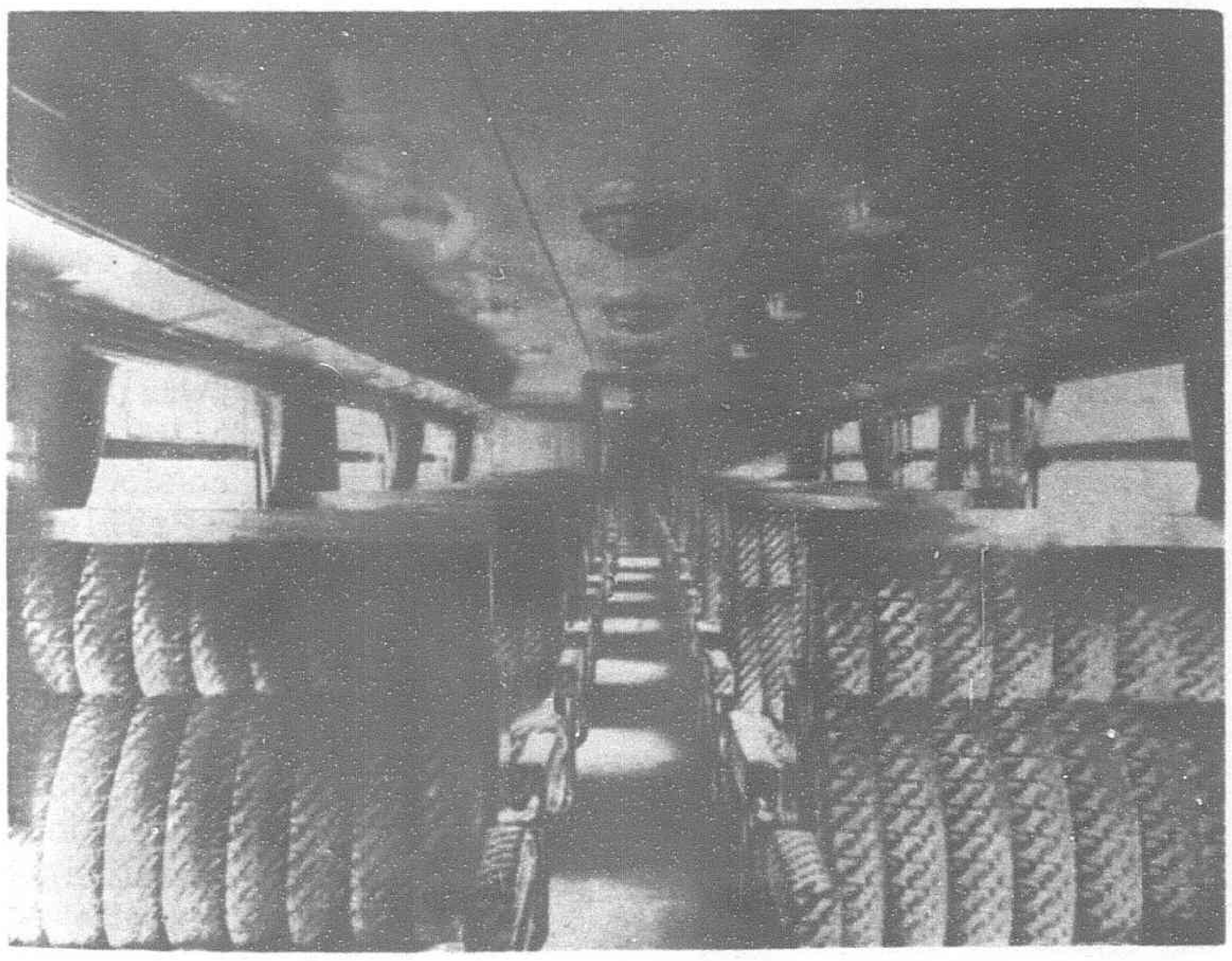


Fig. 11.—Second class compartment of the 1,200 b.h.p. railcar

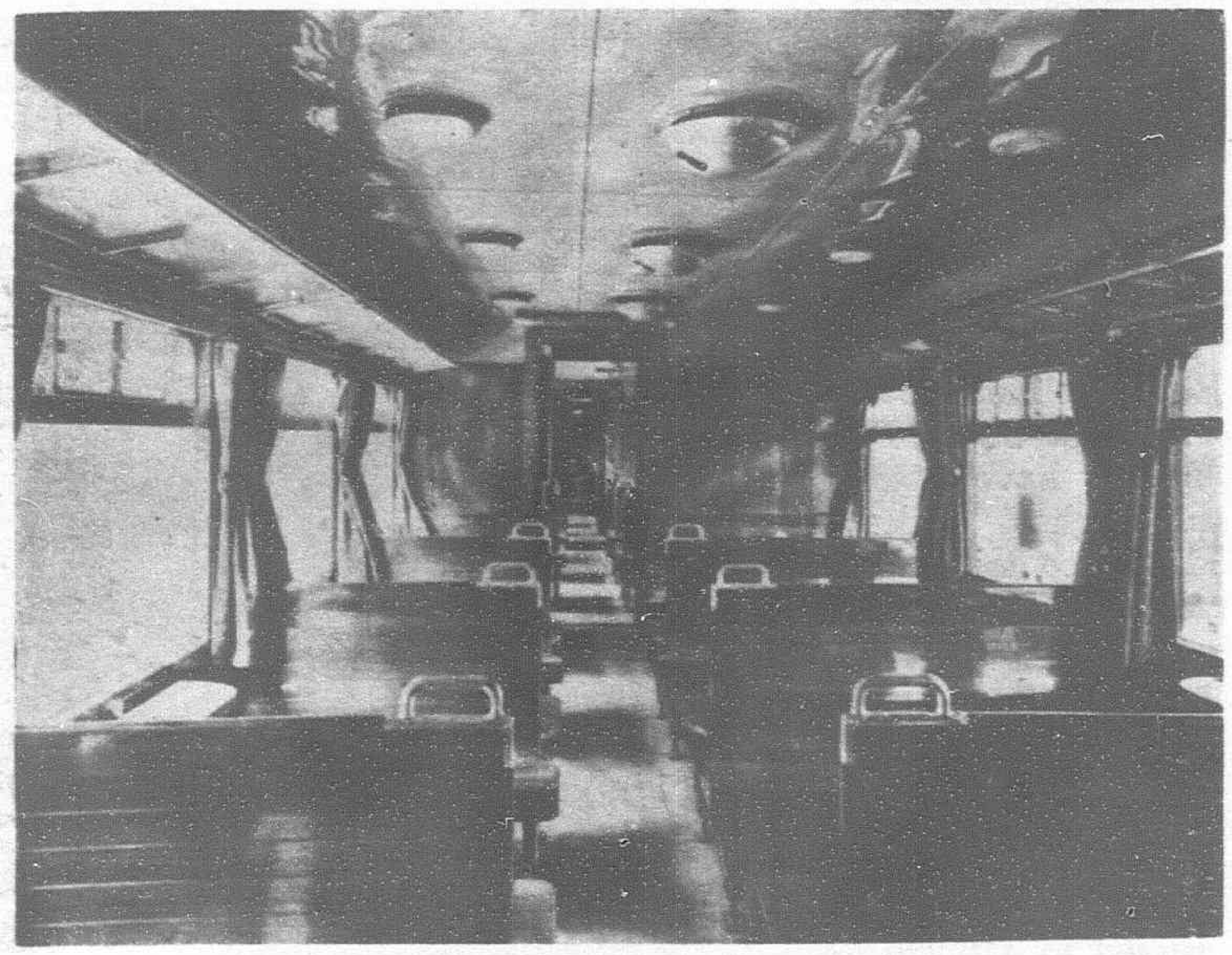


Fig. 12.—Third class compartment of the 1,200 b.h.p. railcar

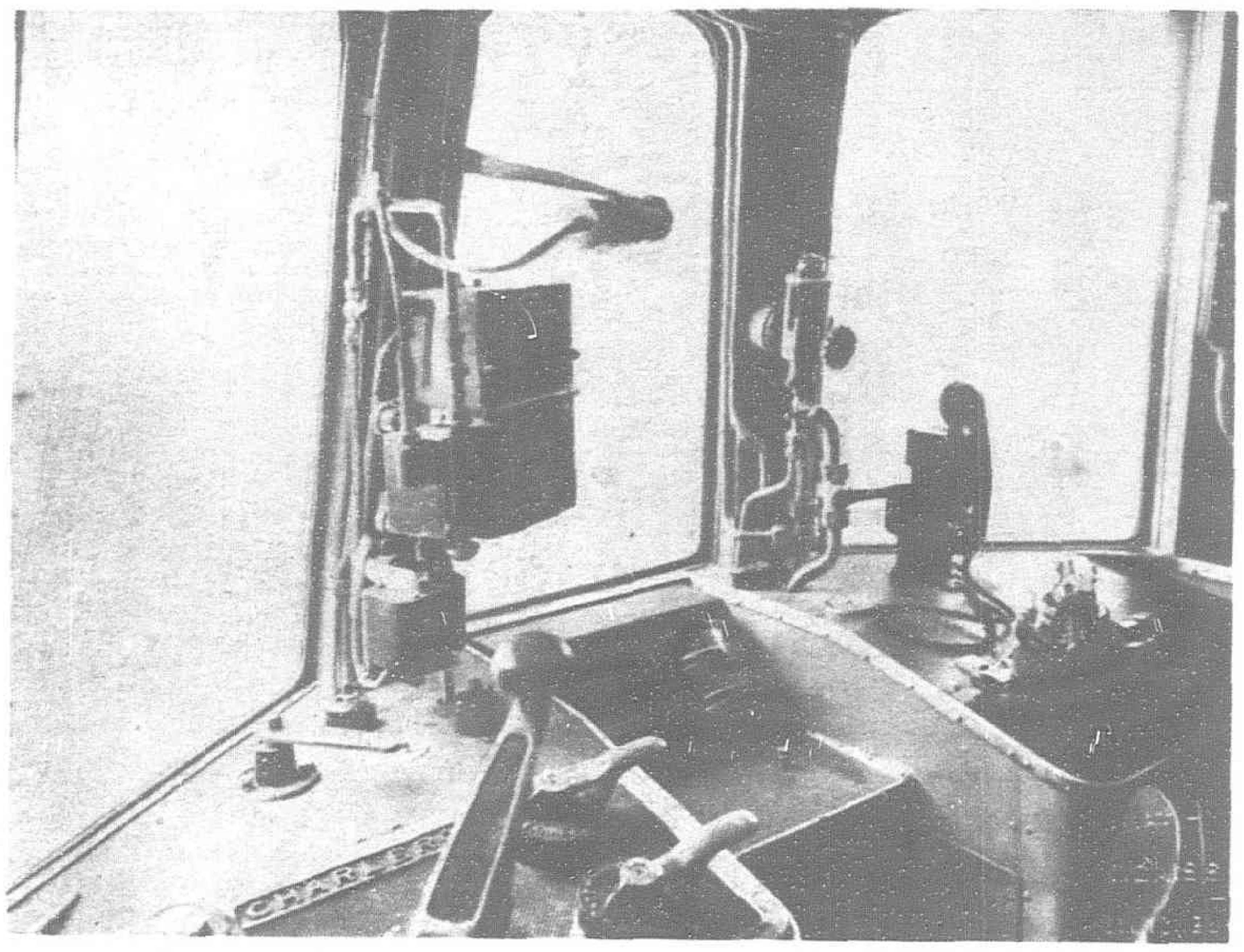


Fig. 14.—Driving position of the 1,200 b.h.p. railcar

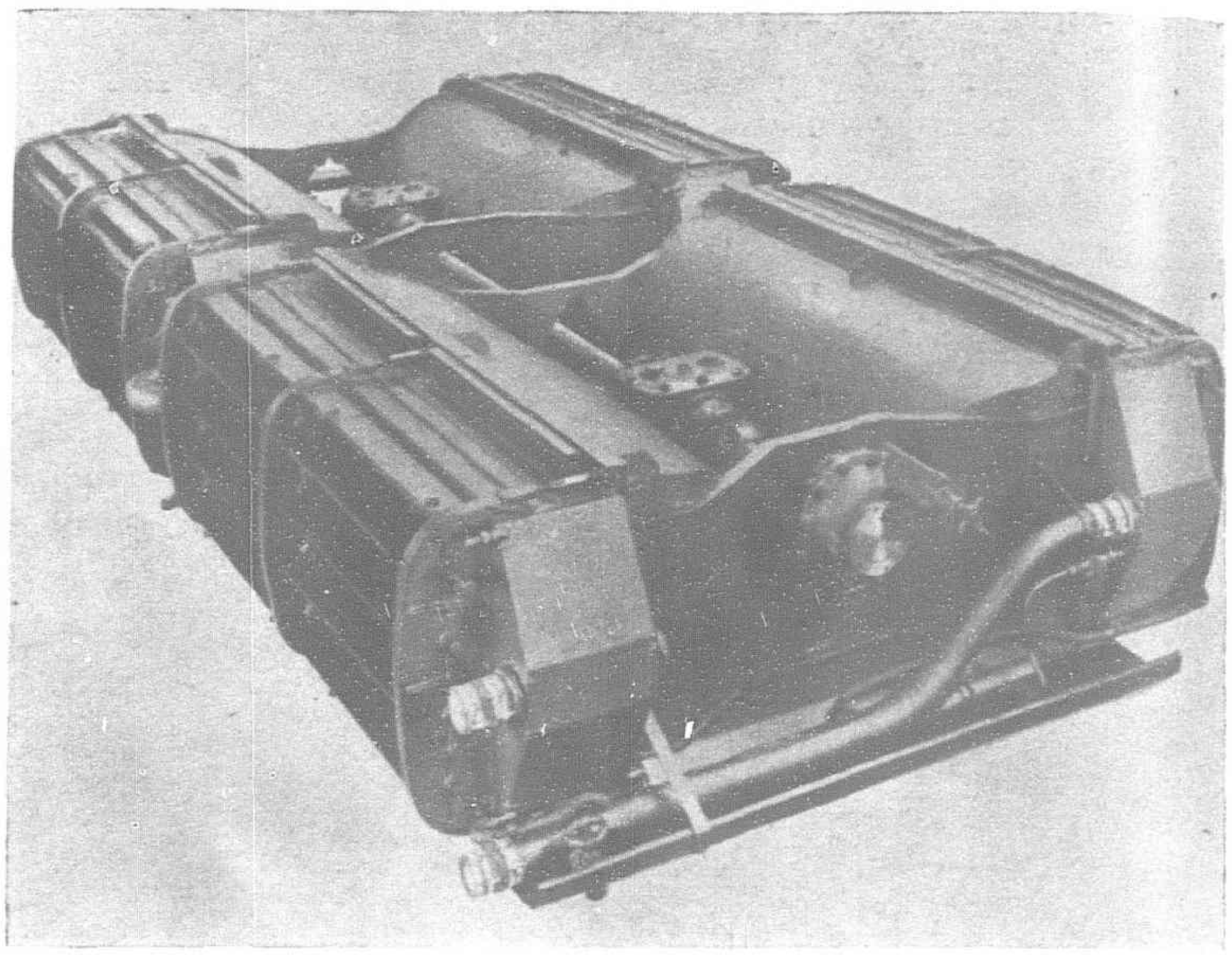


Fig. 15.—Double cooling group of the KKG type of railcars

this type were acquired all of them were equipped with Maybach Diesel engines similar to those installed in the three triple express railcars mentioned above.

Problem of Ventilation

To enhance the popularity of the railcar as a means of transport a special ventilating system was adopted for the three-coach express railcars of the Belgian National Railways. In winter, the foul air is sucked up by special diffusers of an air channel located in the ceiling and expelled into the open air. Heated air is led through a special heating battery and then through distributor ducts to diffusers under the seats in passenger compartments. In summer, the fresh air is led into the upper air channel and diffused into the passenger compartments while the foul air is sucked up under the seats and expelled into the open air. The first eight three-coach express railcars were placed in the Forest depot at Brussels-Midi and in 1936 they were put in express service over the lines shown in Fig. 1. Each railcar subsequently was used in five services run with single, double and triple crews, the daily mileage averaging 828 km. (514.5 miles) per railcar.

Among the triple coach express railcars of the Belgian National Railways those powered with Maybach Diesel engines have attained the highest mileages. The three triple coach railcars so equipped were put into service in 1935 and up to October 1938 each had run 290,663 km. (180,612 miles). By the first of November, 1939, this average had been increased to 416,220 km. (258,630 miles). It is specially noteworthy that of all railcars in service on the Belgian National Railways the three-coach vehicles equipped with Maybach Diesel engines and the fourteen 8-wheeled vehicles have given the most favorable factor of utilization, that is, ratio of operating days to the total working time.

Impressed by the successful operation of the three-coach railcars the Belgian National Railways decided in 1937, to extend their program of operations and employ Diesel-powered railcars in express service. Orders were placed in September, 1937, with the Ste. Ame La Brugeoise et Nicaise and Delcuve and the Ste. Ame Anglo-Franco-Belge for the construction of six new three-car express railcars designed for a maximum speed of 160 km. (100 miles) per hour. As happened in connection with operation of high-speed railcars of the Reichsbahn, the operating results attained on the Belgian National Railways disclosed the advantages of splitting railcar formation to form a train composed of three individual cars permitting universal operation, as illustrated in Figs. 8 and 9.

There is scant differences in the external contours of coach bodies in comparison with the triple-coach railcars. The power bogies, however, have undergone modification with a new design calculated to give the highest degree of security obtainable, as shown in Fig. 10. The new railcar type was designed primarily to afford increased comfort for passengers. Problems of noise damping, heat insulation, interior fittings, and questions of heating and ventilation were solved progressively on the basis of experiences gained from the operation of railcars in service as shown in Figs. 11 and 12.

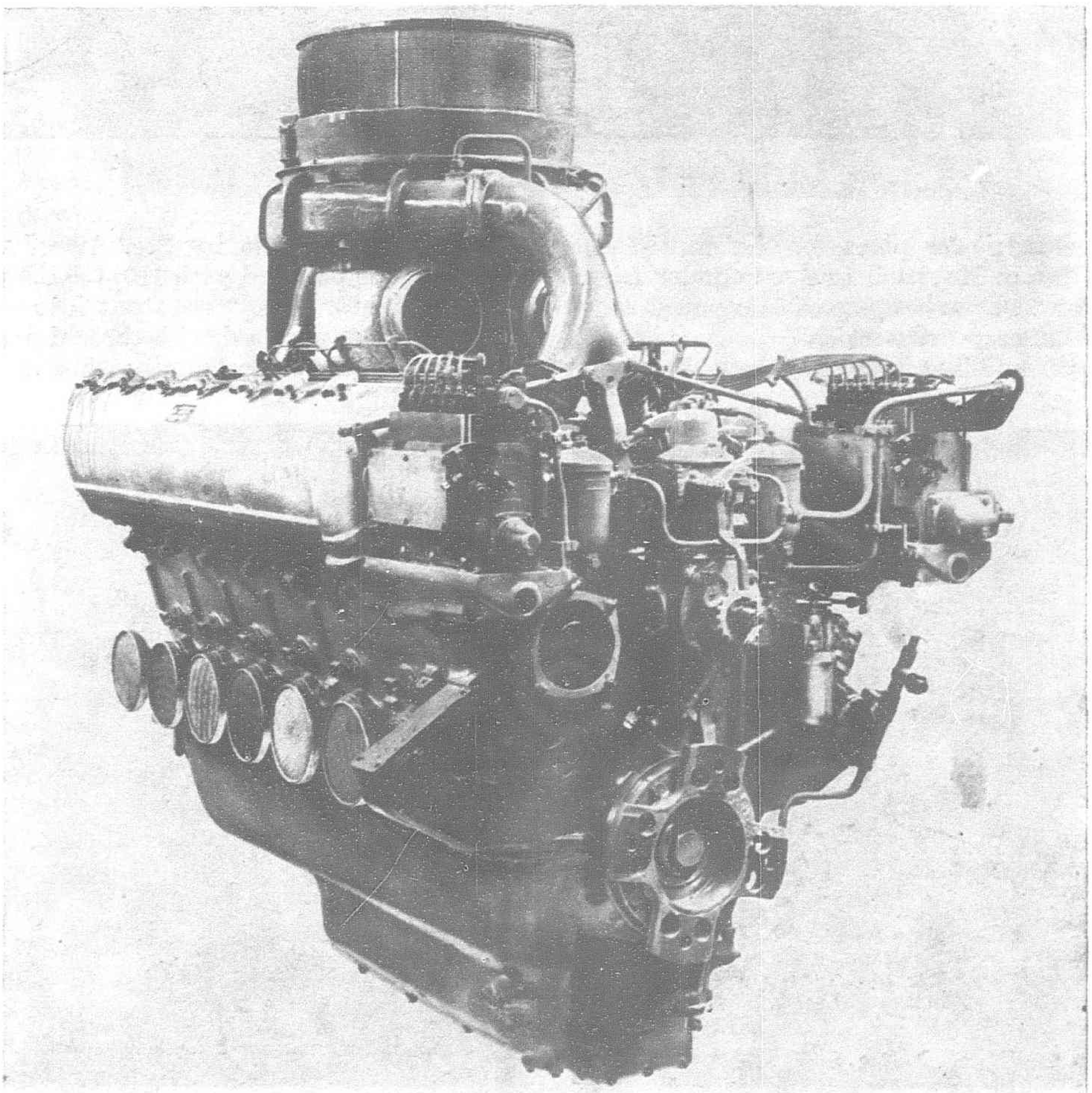


Fig. 13.—The 600/650 b.h.p. twelve-cylinder Maybach Diesel engine

The Need for Greater Power

To be sure, higher demands imposed on the mechanical equipment and power plants of the new railcars and the increased maximum speed involved the necessity to employ a more powerful engine plant than hitherto had been installed in the Belgian express railcars. Again the power plant selected was a Maybach product. For the new service was chosen the well-known twelve cylinder Diesel engine fitted with an exhaust gas turbo supercharging set on the Brown-Boveri-Buchi system, developing 600/650 b.h.p. at 1,400 r.p.m. Two of these engines, each mounted on one of the two end bogies of the railcar formation furnish the requisite motive power for the new railcars, as shown in Figs. 13 and 14. With these new railcars the hydraulic gear box on the Voith-Maybach system was used for the first time on the Belgian National Railways. This hydraulic gear box consists of four converters enclosed in a casing. It is mounted on the power bogie, precisely like the generator in the

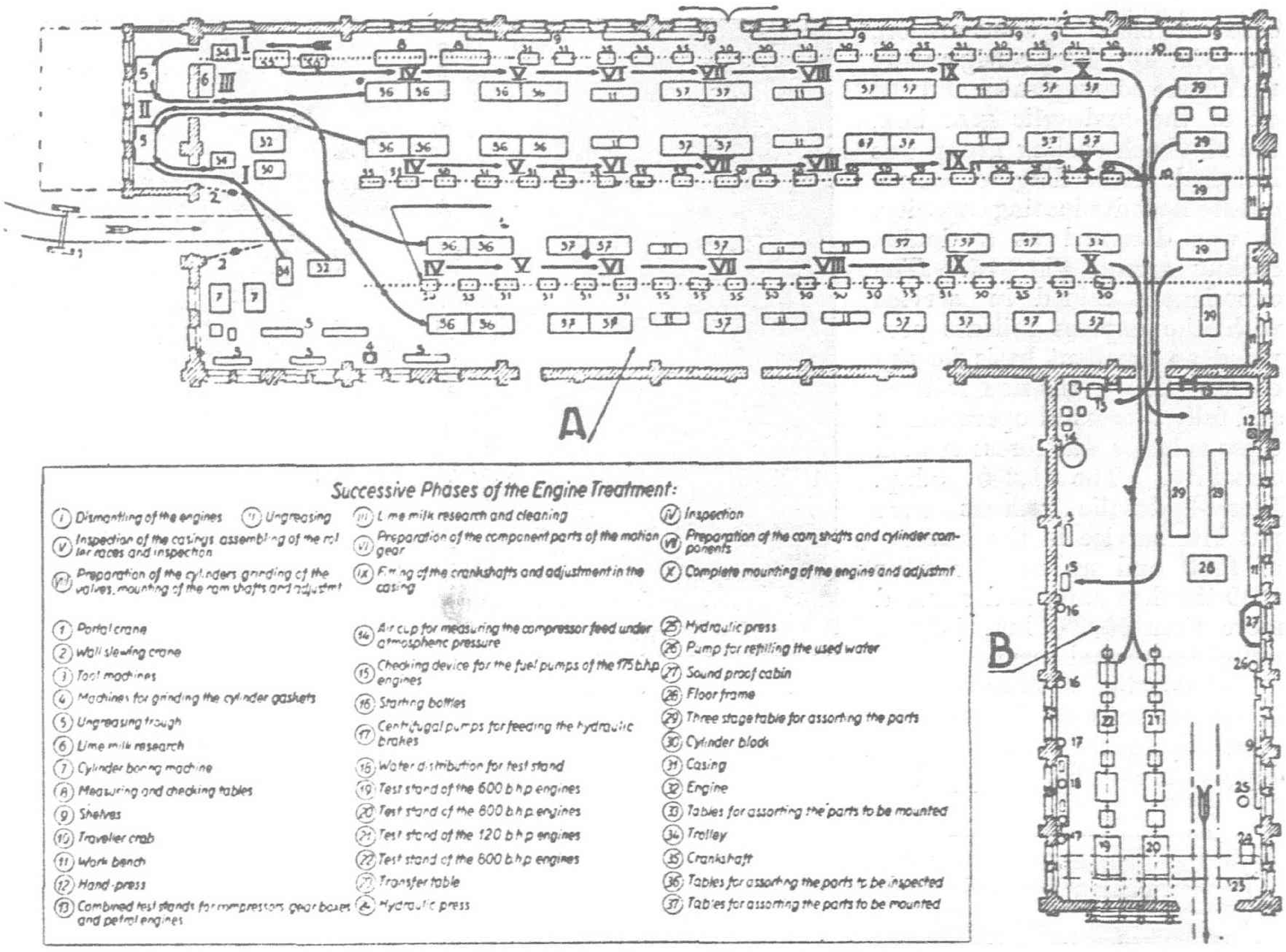
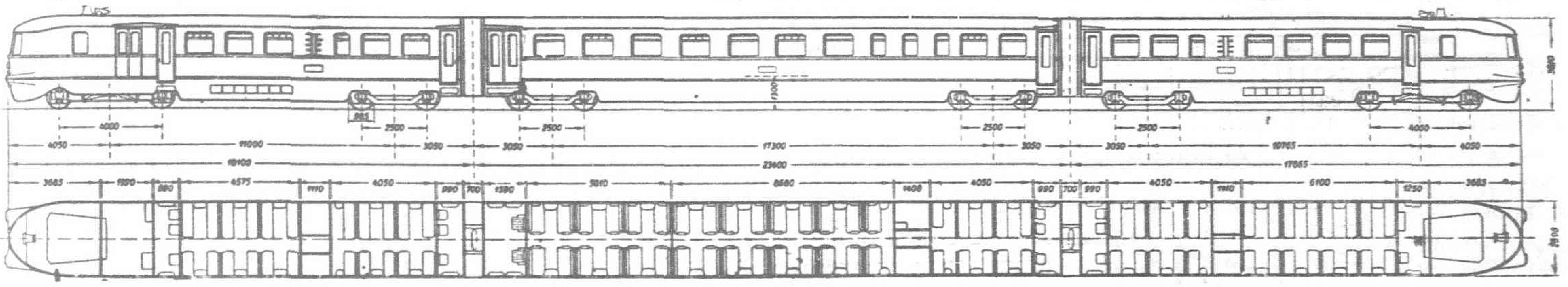
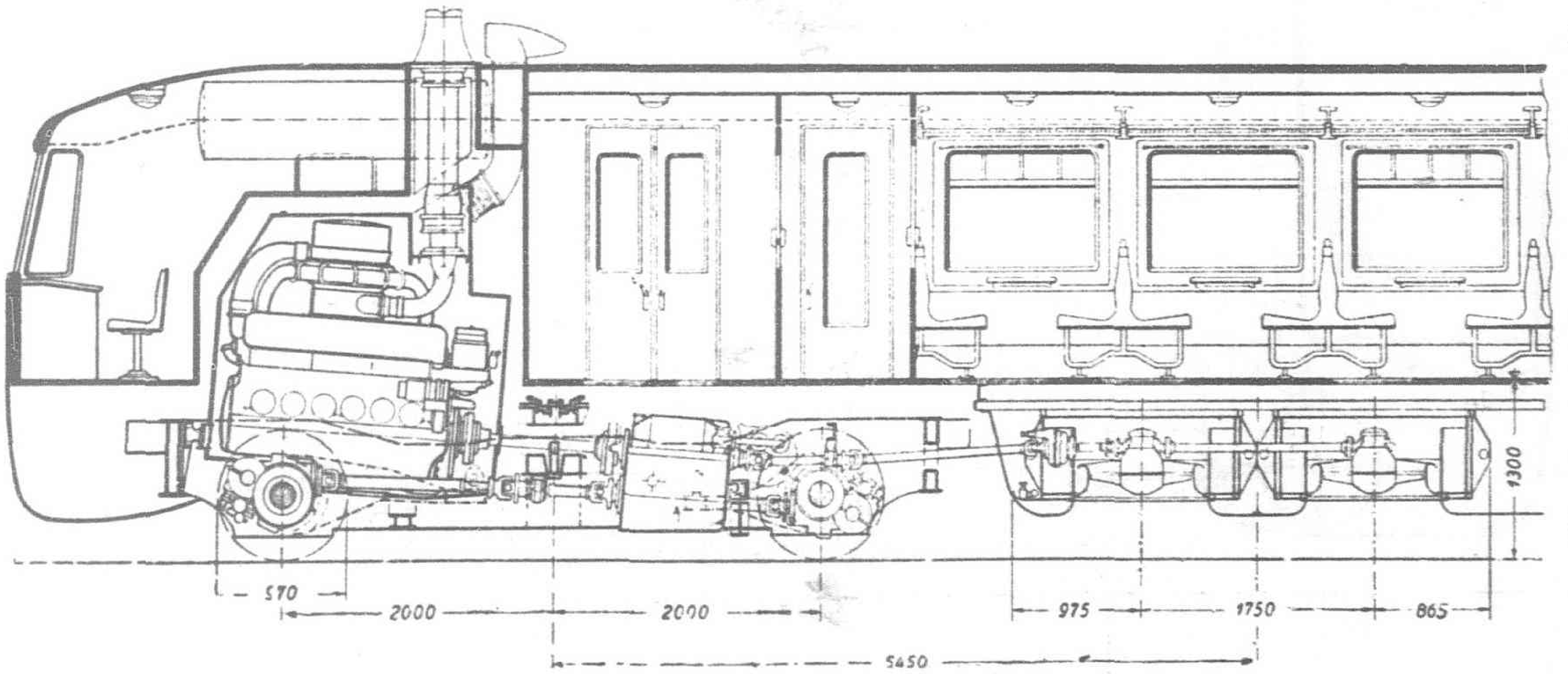

A
B
I
II
III
IV
V
VI
VII
VIII
IX
X
Successive Phases of the Engine Treatment:
(I) Dismantling of the engines
(II) Ungreasing
(III) Lime milk research and cleaning
(IV) Inspection
(V) Inspection of the casings assembling of the roller races and inspection
(VI) Preparation of the component parts of the motion gear
(VII) Preparation of the cam shafts and cylinder components
(VIII) Preparation of the cylinders grinding of the valves, mounting of the cam shafts and adjustmt
(IX) Fitting of the crankshafts and adjustment in the casing
(X) Complete mounting of the engine and adjustmt
(1) Portal crane
(2) Wall slewing crane
(3) Tool machines
(4) Machines for grinding the cylinder gaskets
(5) Ungreasing trough
(6) Lime milk research
(7) Cylinder boring machine
(8) Measuring and checking tables
(9) Shelves
(10) Traveller crab
(11) Work bench
(12) Hand-press
(13) Combined test stands for compressors gear boxes and petrol engines
(14) Air cup for measuring the compressor feed under atmospheric pressure
(15) Checking device for the fuel pumps of the 175 b.h.p. engines
(16) Starting bottles
(17) Centrifugal pumps for feeding the hydraulic brakes
(18) Water distribution for test stand
(19) Test stand of the 600 b.h.p engines
(20) Test stand of the 600 b.h.p. engines
(21) Test stand of the 120 b.h.p engines
(22) Test stand of the 600 b.h.p engines
(23) Transfer table
(24) Hydraulic press
(25) Hydraulic press
(26) Pump for refilling the used water
(27) Sound proof cabin
(28) Floor frame
(29) Three stage table for assorting the parts
(30) Cylinder block
(31) Casing
(32) Engine
(33) Tables for assorting the parts to be mounted
(34) Trolley
(35) Crankshaft
(36) Tables for assorting the parts to be inspected
(37) Tables for assorting the parts to be mounted

Fig. 16.—Plan of the Central Louvain Workshop



1,200 b.h.p. triple express railcars of the Belgian National Railways.—Built in 1939



MECHANICAL PORTION:

Length overall of the railcar unit 59,365 mm. (194′ 9″)

Length overall of the end car with luggage compartment 17,750 m.m. (58′ 3″)

Length overall of the end car without luggage compartment 17,515 mm. (57′ $5\frac{1}{2}$″)

Length overall of the center trailer 22,700 mm. (74′ $2\frac{1}{2}$″)

Width overall of the coach bodies	2,924 mm. (9′ 7″)
Wheelbase of the power bogies	4,000 mm. (13′ $1\frac{1}{2}$″)
Wheelbase of the carrying bogies	2,500 mm. (8′ $2\frac{1}{2}$″)
Tread circle diameter of the wheels.	970 mm. (3′ $2\frac{3}{16}$″)
Number of second class seats	60
Number of second class emergency seats	2
Number of third class seats	144
Number of third class emergency seats	13
Weight of the railcar in working order	139 tonnes
Maximum speed	160 km.p.h. (100 miles)

At each end of the railcar train an engine room with driving position.

Coach builders: La Brugeoise et Nicaise and Delcuve, Bruges, Anglo-Franco-Belge, La Croyère.

Brake: Pressure air brake of Westinghouse type with a braking pressure of 160 per cent down to 80 km.p.h. (50 miles) and automatic change to a braking force of 80 per cent at speeds under 80 km.p.h. (50 miles). Two motor compressors.

Heating and ventilation: Air conditioning system of Westinghouse type. Heating of the air by means of an oil-fired hot-water boiler.

ENGINE PLANT:

Engines: Two 600 b.h.p. Maybach railcar Diesel vee engines with 12 cylinders and airless injection, supercharged on the Büchi system by means of a BBC exhaust-gas turbo pressure charger. n = 1,400 r.p.m., weight 2,300 kg., bore 160 mm. ($6\frac{5}{16}$″), stroke 200 mm. ($7\frac{7}{8}$″).

Starting is effected electrically by means of a Bosch starter mounted on the Diesel engine.

Transmission: By means of a hydraulic Voith-Maybach transmission system with three speeds. At speeds up to 80 km.p.h. (50 miles) (first speed) both axles of the power bogie are driven by a Voith reversing gear. At speeds from 80 to 125 km.p.h. (50 to 77.7 miles) (second speed) only the inner axle is driven and at speeds above 125 km.p.h. (77.7 miles) (third speed) only the outer axle is driven.

Control is effected electrically by a servo motor.

Running positions: Five corresponding to engine speeds of 1,100—1,175—1,250—1,325—1,400 r.p.m. Idling speed 600 r.p.m.

Fuel storage per engine plant: Two tanks containing 900 litres (198 gal.).

Recooling of the engine cooling water by the action of a Maybach underfloor double cooling group with ventilator fan drive from the free shaft end of the hydraulic gear box.

Battery for starting and lighting: 48 elements with a capacity of 240 amp. hr. and a tension of 96-volts.

case of electric transmission, see Fig. 10. For refrigerating the engine cooling water and the oil of the hydraulic gear box, the Maybach cooling group was installed. According to the requisite heat dissipating capacity, it was designed as a double cooling group, Fig. 15. The experiences gained in service with the express railcars provided an excellent basis for the construction of the new railcars and fully successful operation of these vehicles was foreseen with certainty. The 1,200 b.h.p. Diesel-hydraulic railcars were put into service in the summer of 1939 and up to December 1939 the first units had covered more than 50,000 km. (31,069 miles) in normal service.

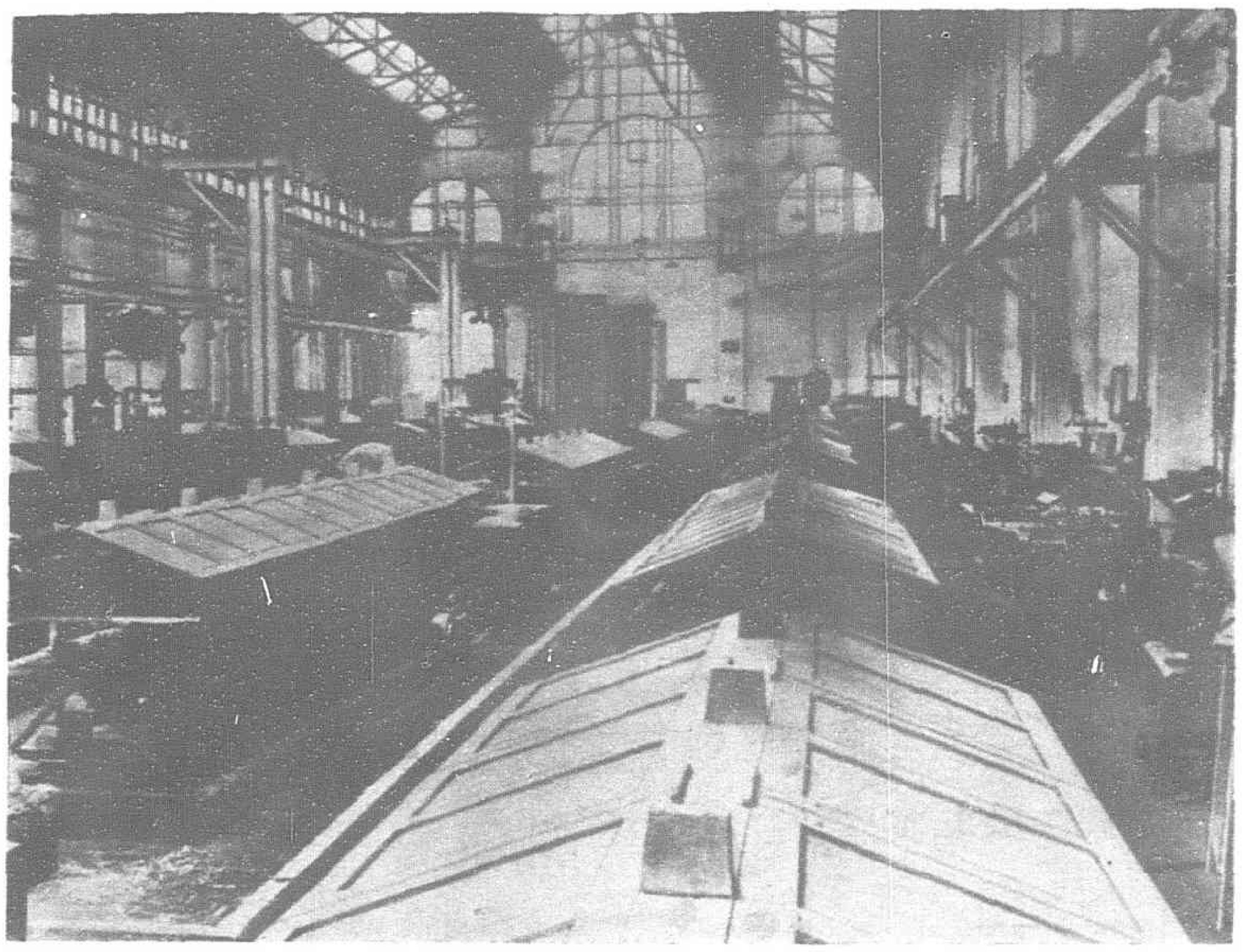
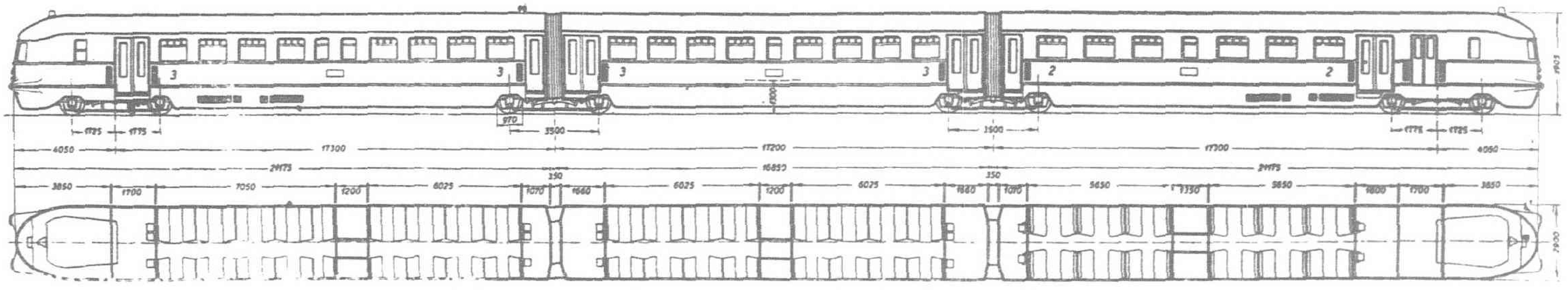


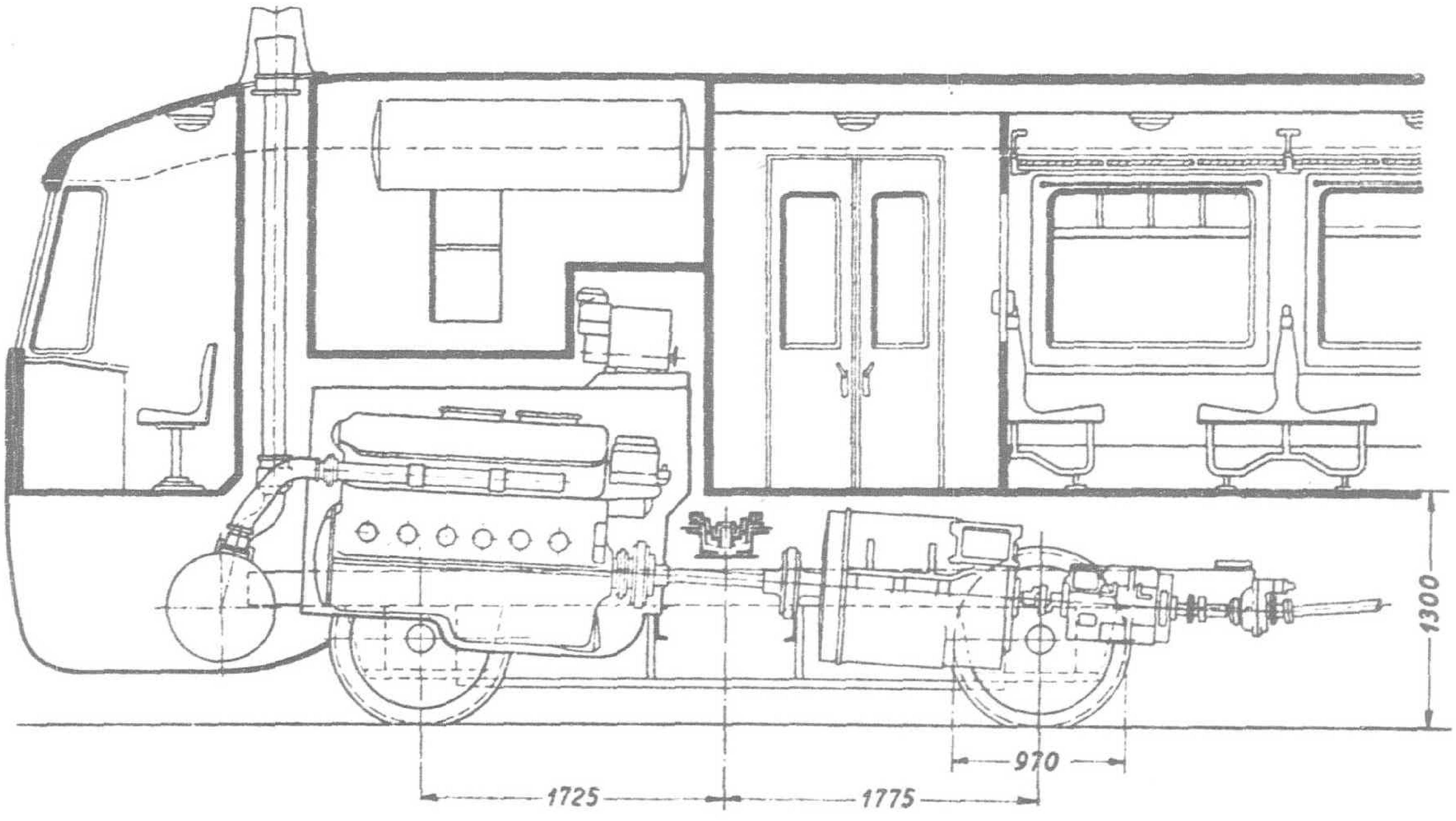
Fig. 17.—Erecting shop in the Central Louvain workshop

Stationing of these vehicles in special railway depots is of vital importance for an economical railcar service. Such railway depots must be equipped with plant necessary for lesser overhauls. Service and maintenance conditions are most sastisfactory when as large a number of railcars as possible are under a single management and control, that is to say, when the number of railway depots is restricted to the minimum. Such concentration is of special value for the overhaul of railcars carried out at regular intervals. Although normal daily, weekly and monthly, overhauls can be carried out in the few depots where the railcars are stationed, main overhauls need to be made in special workshops called central workshops. On the Belgian National Railways mechanical parts of the railcars are inspected and overhauled in the central Malines workshop and engine equipment in the Louvain workshop. In this was created a complete centralization of all railcar repair

(Continued on page 296)



820 b.p.h. triple express railcars of the Belgian National Railways.—Built in 1936



MECHANICAL PORTION:

Length, overall of the railcar 59,900 mm. (196′ 6″)

Length overall of the end cars 21,175 mm. (69′ 5¾″)

Length overall of the trailer 16,850 mm. (65′ 1½″)

Width overall of the coach bodies 2,927 mm. (9′ 7¼″)

Wheelbase of the power bogies 3,500 mm. (11′ 6″)

Wheelbase of the traction bogies 3,500 mm. (11′ 6″)

Tread circle diameter of the wheels.	970 mm. (3′ 2$\frac{3}{16}$″)
Number of second class seats	48
Number of second class emergency seats ..	4
Number of third class seats	165
Number of third class emergency seats	12
Weight of the railcar in working order	128 tonnes
Maximum speed	150 km.p.h. (93.2 miles

At each end of the railcar train an engine room with driving position.

Coach builder: La Brugeoise et Nicaise and Delcuve, Bruges.

Brake: Pressure air brake of Westinghouse type with two compressors each driven by a 8.5 b.h.p. electric motor.

Heating and ventilation: Air conditioning system of Westinghouse type. Heating of the air either by the engine cooling water or by electric resistances or by steam.

Battery for starting and lighting: 48 elements with a capacity of 240 amp. hr. and a tension of 96-volts.

ENGINE PLANT:

Engines. Two 410 b.h.p. Maybach railcar Diesel vee engines with 12 cylinders and airless injection; n = 1,400 r.p.m., weight 2,100 kg., bore 160 mm. (6$\frac{5}{16}$″), stroke 200 mm. (7⅞″).

Starting is effected electrically by means of the main generator.

Transmission: Electric, on the Jeumont system. Continuous capacity of the generator 260 kw. maximum tension 645-volts at 1,400 r.p.m. One hour capacity of the generator 340 kw., maximum tension 710-volts, at 1,400 r.p.m. Each power plant comprises two electric traction motors mounted on the articulation bogies of the train. They have a one-hour capacity of 210 b.h.p. at 1,300 r.p.m. and 246 amp. and a continuous capacity of 116 b.h.p. at 1,420 r.p.m. and 194 amp. each. auxiliary generator: 14 kw. at 1,400 r.p.m. Exciter engine: 4.5 kw.; 57.5-volt; 75 amp; 1,800 r.p.m.

Arrangement: Each end bogie carries the Diesel engine with main and auxiliary generators.

Control is effected electrically by a servo motor with simultaneous change of the generator excitation.

Running positions: Five corresponding to engine speeds of 1,100—1,175—1,250—1,325—1,400 r.p.m. Idling speed 800 r.p.m.

Fuel storage per engine set: Three tanks containing 900 litres (198 gal.).

Recooling of the engine cooling water by underfloor radiator being mechanically driven off the free shaft end of the generator.

Air-Conditioning of Passenger Cars on the F.M.S. Railways

By W. F. WEGENER, A.M.I.C.E., M.I.L.E.

(Journal of the Engineering Association of Malaya)

It is not the intention of the author of this paper to recapitulate the principles underlying air conditioning. The present paper, as its title implies, deals with the application of air conditioning to Railway passenger cars, particularly those of the F.M.S. Railways, the experience obtained with the cars in service, and the effect upon the design of new ones under construction.

The study and application of comfort air conditioning for Railway vehicles has received very little consideration from Railway Engineers outside the United States of America. The highly developed stage to which its application has reached in the United States is due, in no small measure, to the extremes of climate through which the railroads operate, where it is possible within 36 hours to pass from conditions in which the temperature is below zero to semi-tropical conditions.

Comfort air conditioning was the only answer to such wide ranges of temperature and it has now become of paramount importance in meeting the competition of other forms of travel. At present there are in service in that country 10,900 air conditioned cars, representing about 99 per cent of the world's total Railway vehicles so equipped. It is believed that outside American territory there were no Railway passenger cars fitted with air conditioning equipment until the year 1934 when Australia took the lead and placed a number of these in service.

Railway passenger car air conditioning presents many problems not usually encountered in the design of stationary air conditioning plant. The designer of the latter is usually allotted plenty of room by the architect to install his equipment; he provides a good, solid foundation for it and is not greatly concerned if its weight is in excess of that considered to be absolutely necessary. He is able to house his control apparatus in a position where there is little risk of it becoming deranged due to vibration.

The designer of the Railway passenger car equipment on the other hand is restricted considerably by space and weight limitations and as such his calculations of heat load with which the plant is to deal must be made to a nicety. Solar heat affects his calculations to a greater extent than those for the stationary plant and the more variable climatic conditions complicate matters further. Above all, he must pay careful attention to the necessity for its absolute reliability during the long periods of operation of the car between stations where examination and adjustments can be made.

Since there are few physical reasons why any properly designed and applied type of air conditioning equipment will not provide entire satisfaction under nearly all operating conditions, the selection of a particular type resolves itself into a question of economics. The economics of air conditioning are affected by a number of factors.

These are :—

(i) The length of the cooling season.

(ii) The atmospheric conditions prevailing during the cooling season.

(iii) The average speed in miles per hour, and

(iv) The total vehicle miles per year.

With these considerations in view, the various types of air conditioning in commercial manufacture for Railway work were investigated for the purpose of arriving at the one best suited to Malayan conditions. This investigation was somewhat hampered by the fact that neither the Railways' Consultants in England nor British Manufacturers had had any previous experience in Railway air conditioning, and consequently some two years were taken up in preliminary work alone. Although American Railway Engineers had developed the Air Conditioning of passenger cars to a high degree, their designs could not be adopted in their entirety for the F.M.S. Railways owing to the space and weight limitations imposed by the difference in gauges of the tracks and to the fact that, in Malaya, there is no seasonal change.

Systems in Use for Air Conditioning

The following well-known systems of air conditioning received consideration :—

(i) The steam ejector system,

(ii) The ice activated system,

(iii) The mechanical compression system, and a short description of each of these will be given.

Reference is invited to Figure 1, showing in diagrammatic form the steam ejector system; also Figures 2 and 3, showing the ice activated and mechanical compression systems.

Steam Ejector System

The refrigerating medium in the steam ejector system is water and the method of operation is as follows :—

(1) Water, at a low temperature and a pressure approximately equal to, or somewhat below, that of the atmosphere is circulated through the air cooling coil (*a*) where it absorbs heat from the air mixture and then leaves this coil (*a*) at a temperature higher than that at which it entered.

(2) The water from the air cooling coil (*a*) is sprayed, into the water evaporator (*b*) where a pressure very much below that of atmosphere is maintained. Owing to the lowered pressure, the heat absorbed by the water causes a small part of it to evaporate and a reduction in temperature takes place.

(3) To maintain the low pressure in the water evaporator (*b*), the water vapor is removed thereform as fast as it is developed. This is accomplished by the steam ejector (*c*).

(4) Ejector (*c*) is operated by steam from the locomotive boiler. The steam expands in the nozzle of the ejector, thus attaining a high velocity.

(5) The high velocity steam entrains the water vapor from evaporator (*b*), forming a mixture in the converging cone of the ejector.

(6) The mixture of water vapor and steam is discharged into steam condenser (*d*) against a higher pressure, which is still far below that of the atmosphere. This results in a lowered velocity and an increased temperature of the mixture.

(7) The mixture of steam and water vapor is condensed

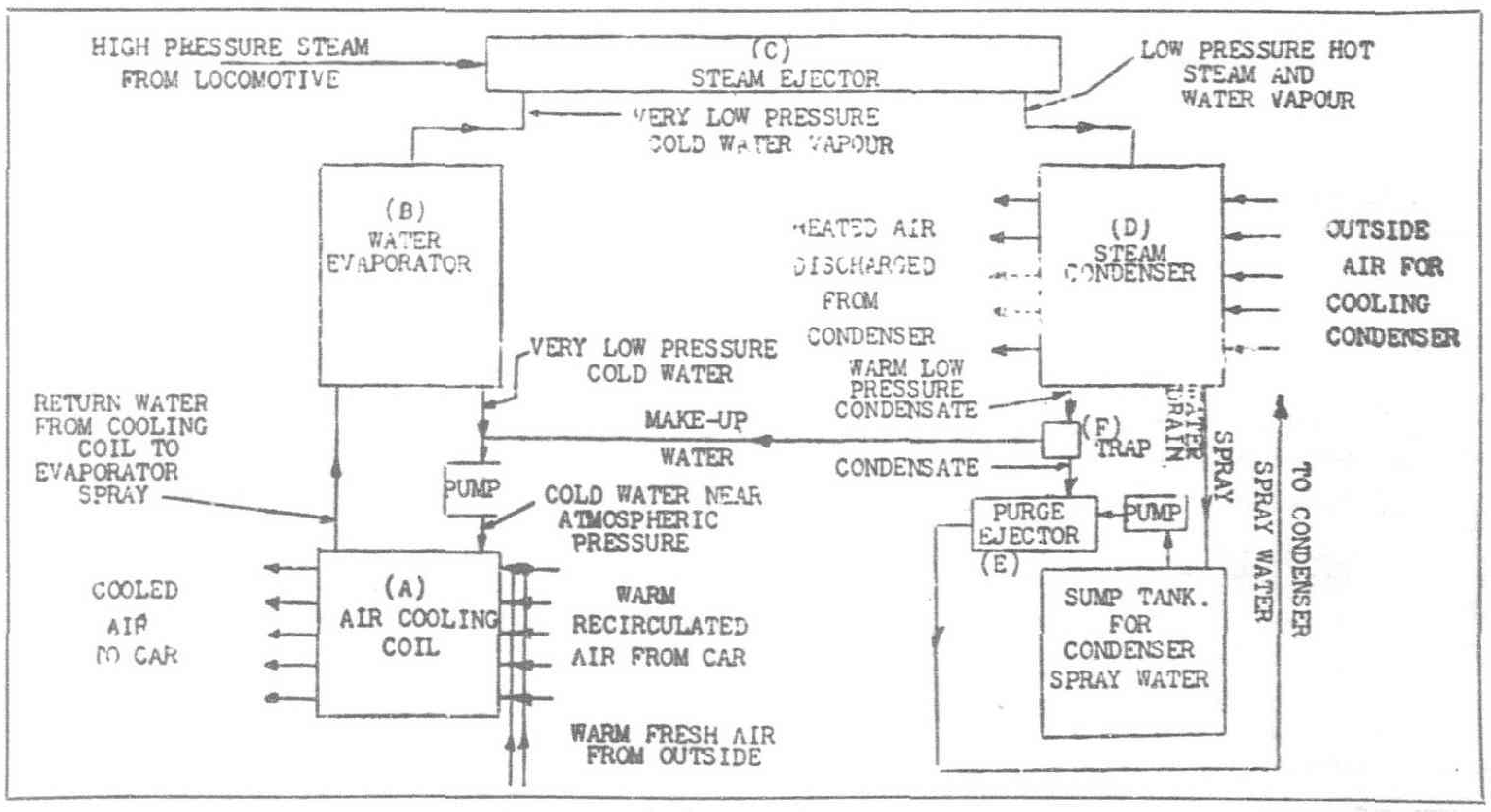

HIGH PRESSURE STEAM FROM LOCOMOTIVE
(C) STEAM EJECTOR
LOW PRESSURE HOT STEAM AND WATER VAPOUR
VERY LOW PRESSURE COLD WATER VAPOUR
(B) WATER EVAPORATOR
HEATED AIR DISCHARGED FROM CONDENSER
(D) STEAM CONDENSER
OUTSIDE AIR FOR COOLING CONDENSER
VERY LOW PRESSURE COLD WATER
WARM LOW PRESSURE CONDENSATE
RETURN WATER FROM COOLING COIL TO EVAPORATOR SPRAY
MAKE-UP WATER
(F) TRAP
WATER DRAIN
SPRAY
CONDENSATE
PUMP
COLD WATER NEAR ATMOSPHERIC PRESSURE
PURGE EJECTOR (E)
PUMP
TO CONDENSER SPRAY WATER
COOLED AIR TO CAR
(A) AIR COOLING COIL
WARM RECIRCULATED AIR FROM CAR
SUMP TANK. FOR CONDENSER SPRAY WATER
WARM FRESH AIR FROM OUTSIDE

Fig. 1.—The steam ejector system flow diagram

in steam condenser (*d*) by the transfer of heat from the mixture to the condenser cooling medium which consists of outside air and a spray of water.

(8) The purge ejector (*e*) removes the condensate and maintains a low pressure in condenser (*d*). The purge ejector is operated by pumping the condenser spray water through it.

(9) Water, in an amount equivalent to the vapor removed, must be supplied to the evaporator. Part of the condensate from the steam condenser is used for this purpose. Water, from a trap (*f*), located in the pipe line between the steam condenser (*d*) and the purge ejector (*e*), flows into the water evaporator (*b*) through the air cooling coil (*a*) due to the difference between the pressure in the condenser and that in the evaporator.

This system has been developed for use in countries with seasonal climatic changes and on Railways where steam is used on the non-air-conditioned cars for heating during the cool season. The capital cost of the steam supply pipes from the locomotive is not a charge on the air conditioning apparatus although the latter should bear part of the maintenance costs.

Ice Activated System

The process of refrigeration as described for the steam ejector system is not required with the ice activated system. The refrigeration process is already accomplished in making the ice. The air conditioning, therefore, of a car by the ice activated system consists of bringing the air to be used in a car into such relationship with ice as to cause the temperature of the air to be lowered. The method whereby this is done is shown by the flow diagram, Figure 2.

The operation is as follows :—

(1) Water, which has been cooled in an ice bunker (*a*), is circulated through an air cooling coil (*c*) by means of pump (*b*).

(2) Warm air from the car is blown over cooling coil (*c*). During the passage of the air over the cooling coil, the cold water therein absorbs some of the heat in the air. Thus the temperature of the air is lowered. In some equipments the air is further cooled by spraying cold water into the air stream.

(3) The warm water leaving the cooling coil (*c*) is returned to ice bunker (*a*). Here it is brought into such relationship with the ice that the ice absorbs heat from the water. The water is cooled again and recirculated. The absorption of heat by the ice melts it.

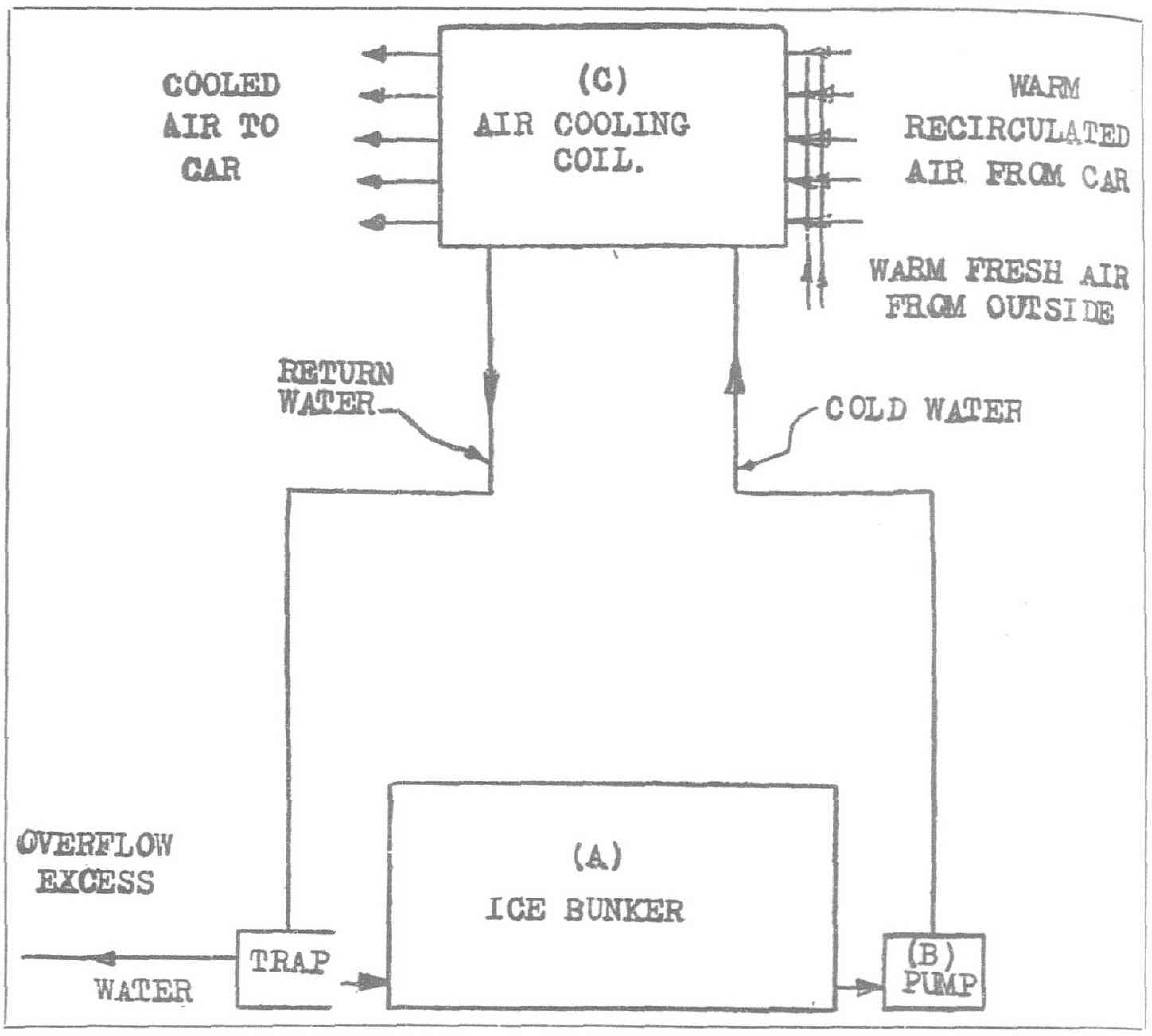


Fig. 2.—The ice activated system flow diagram

This system has been developed also for operation in countries with seasonal changes and its installation, where the cooling season is of short duration and where ice at low cost can be obtained, offers very considerable economies over other systems. Adequate supplies of ice along the route of operation of vehicles equipped with this system must of course be available.

Mechanical Compression System

The method of operation of this system is shown in flow diagram, Figure 3.

(1) The refrigerant in a liquid state and at high pressure in the receiver or storage reservoir (*a*) is forced by its pressure through an expansion valve (*b*). The refrigerant universally used is dichlorodifluoromethane, commercially known as " Freon " or " F12."

(2) The expansion valve (*b*) controls the flow of the liquid refrigerant from the high pressure receiver (*a*) to the air cooling coil or refrigerating evaporator (*c*), where a low pressure exists. Due to the reduction in pressure, a portion of the refrigerant evaporates, thereby lowering the temperature.

(3) The low-temperature refrigerant, in flowing through the air cooling coil (*c*), absorbs heat from the air passing over the coil. This absorption of heat vaporizes the refrigerant.

(4) The refrigerant vapor flows to the suction side of the mechanical refrigerating compressor (*d*) where it is compressed. This raises both its pressure and temperature. The power required to drive the compressor may be obtained from an electric motor or directly coupled internal combustion engine.

(5) The high-pressure, high-temperature refrigerant vapor is discharged from compressor (*d*) into the refrigerating condenser, or heat exchanger (*e*), where heat is transferred from the refrigerant to the cooling medium passing over the condenser coils. The cooling medium is either outside air or a combination of air and water. Thus the refrigerant is condensed to a liquid state.

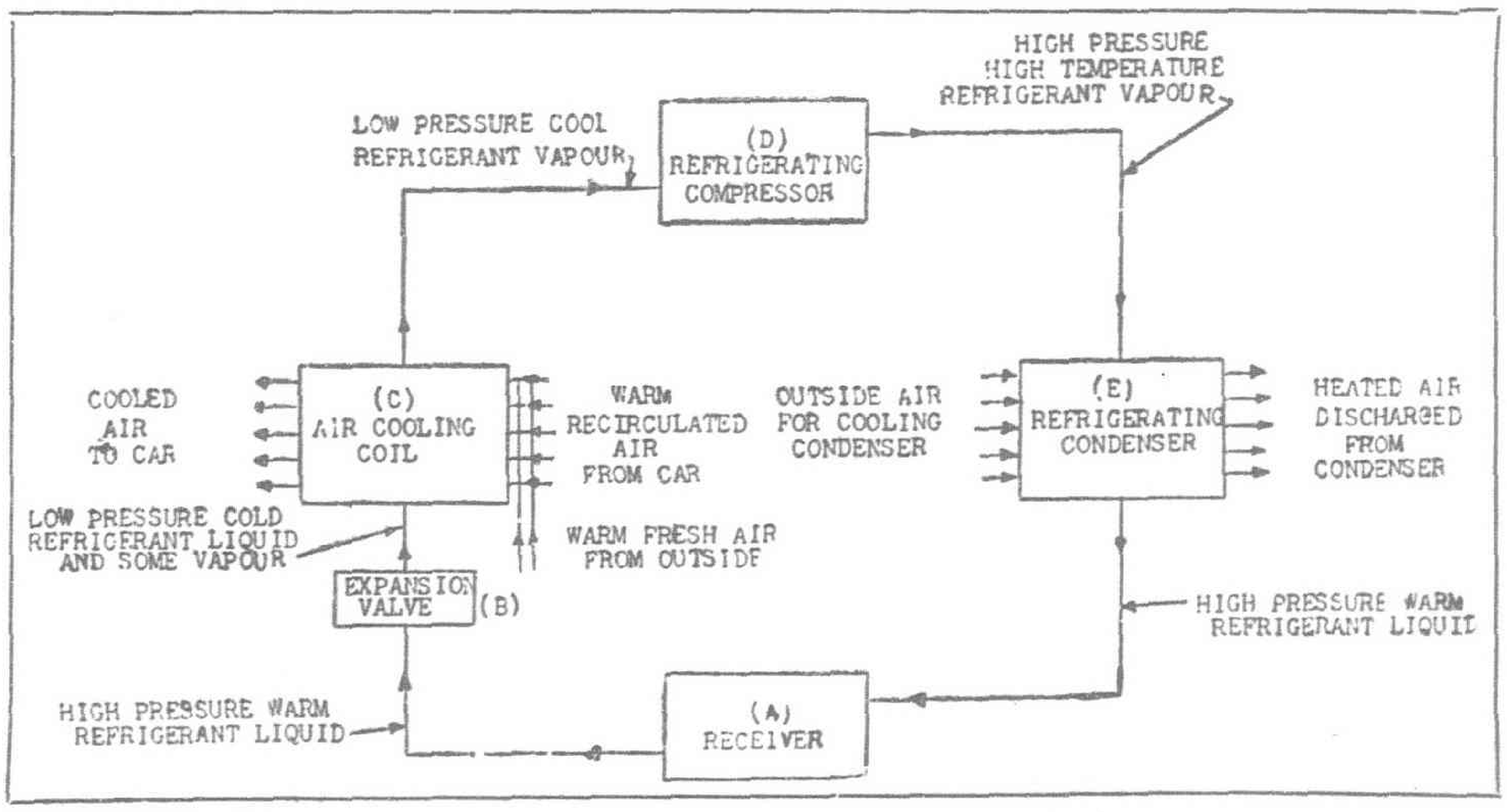

HIGH PRESSURE HIGH TEMPERATURE REFRIGERANT VAPOUR
LOW PRESSURE COOL REFRIGERANT VAPOUR
(D)
REFRIGERATING COMPRESSOR
COOLED AIR TO CAR
(C)
AIR COOLING COIL
WARM RECIRCULATED AIR FROM CAR
OUTSIDE AIR FOR COOLING CONDENSER
(E)
REFRIGERATING CONDENSER
HEATED AIR DISCHARGED FROM CONDENSER
LOW PRESSURE COLD REFRIGERANT LIQUID AND SOME VAPOUR
WARM FRESH AIR FROM OUTSIDE
EXPANSION VALVE
(B)
HIGH PRESSURE WARM REFRIGERANT LIQUID
HIGH PRESSURE WARM REFRIGERANT LIQUID
(A)
RECEIVER

Fig. 3.—The mechanical compression system flow diagram

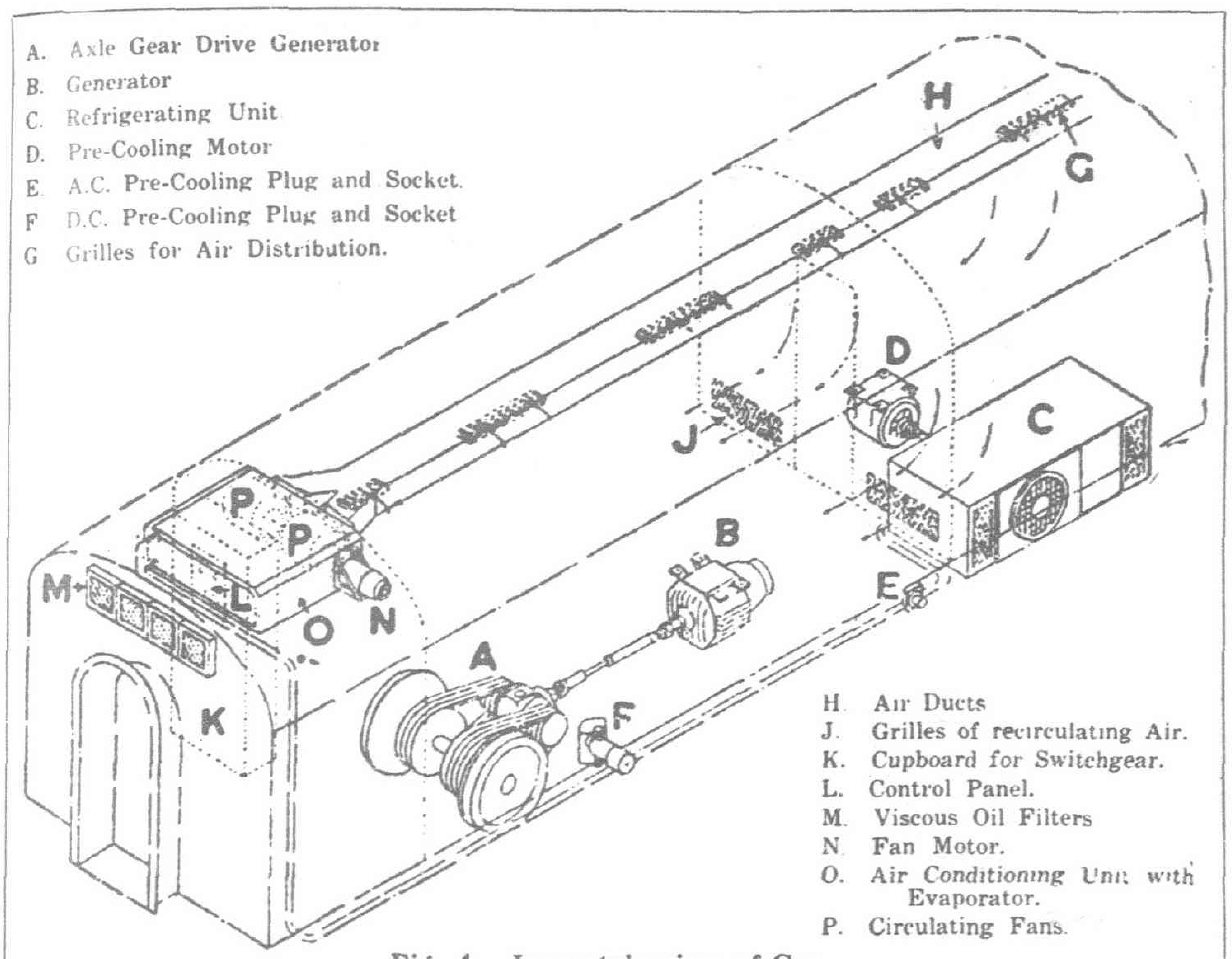

A. Axle Gear Drive Generator
B. Generator
C. Refrigerating Unit
D. Pre-Cooling Motor
E. A.C. Pre-Cooling Plug and Socket.
F. D.C. Pre-Cooling Plug and Socket
G. Grilles for Air Distribution.
H. Air Ducts
J. Grilles of recirculating Air.
K. Cupboard for Switchgear.
L. Control Panel.
M. Viscous Oil Filters
N. Fan Motor.
O. Air Conditioning Unit with Evaporator.
P. Circulating Fans.
A
B
C
D
E
F
G
H
J
K
L
M
N
O
P
P

Fig. 4.—Isometric view of Car

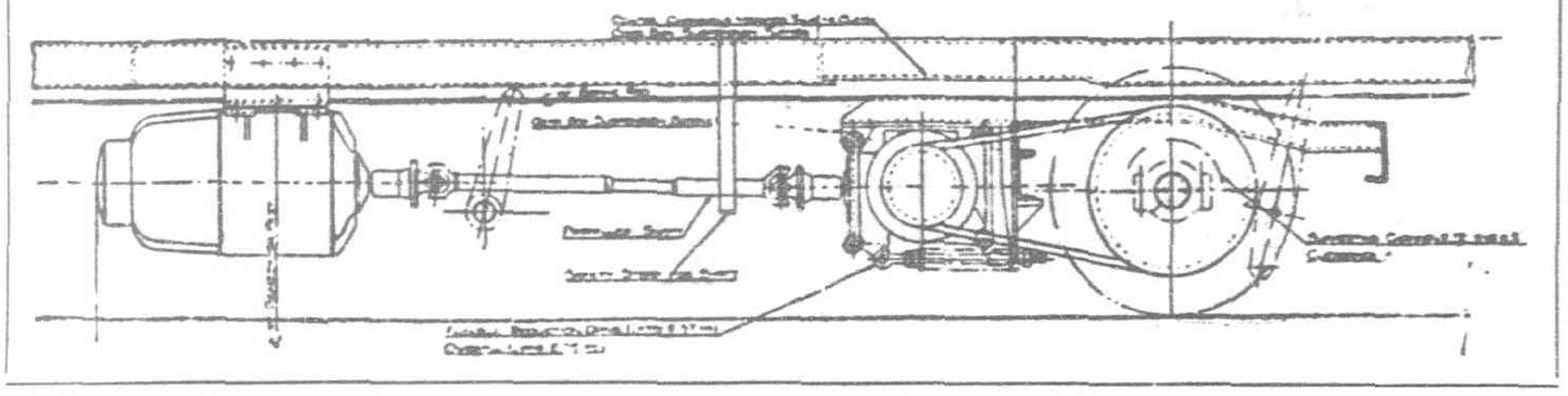


Fig. 5.—Generator drive—elevation

(6) The liquid refrigerant at high pressure flows from the refrigerating condenser (*e*) into the storage reservoir (*a*), after which the cycle is repeated.

Fixed charges are by far the largest component of the total operating costs except the ice activated system, where the longer the cooling season, the greater becomes the operating costs.

The author is indebted to the Division of Equipment Research of the Association of American Railroads for the following comparative information on the three systems given in the findings of the Research Report on the Air Conditioning of 789 Railway Passenger Cars, which included 274 electro-mechanical, 152 steam ejector and 363 ice activated equipments :—

(1) *Gross installation costs*

	Gold
Ice activated system	$3,982
Electro-mechanical compression system	6,484
Steam ejector system	8,475

(2) Fixed charges per 1,000 car miles on the *basis of 150,000 total car miles per year.*

Ice activated system	$ 5.11
Electro-mechanical compression system	.845
Steam ejector system	11.18

(3) Operating cost per 1,000 car miles for a cooling season of five months and an *average train speed of 50 m.p.h.*

Electro-mechanical compression system	$ 0.99
Steam ejector system	1.02
Ice activated system	5.29

(4) *Maintenance cost per 1,000 car miles.*

Ice activated system	$ 0.97
Steam ejector system	2.15
Electro-mechanical compression system	3.33

(5) Total operating cost per 1,000 car miles, including fixed charges, operating and maintenance costs, an average train speed of 50 m.p.h. and a total mileage of *150,000 car miles per year.*

(*a*) *Three month cooling season.*

Ice activated system	$ 9.48
Electro-mechanical compression system	12.63
Steam ejector system	14.25

(*b*) *Ten month cooling season.*

Electro-mechanical compression system	$13.14
Steam ejector system	14.62
Ice activated system	16.95

These figures are of considerable interest and show that the ice activated system is,

(*a*) the least costly to install,
(*b*) the least costly to maintain,
(*c*) the most costly over a lengthy cooling season when all-in-costs are considered,

and that the all-in-cost of the electro-mechanical compression system is the least.

Summing up the merits of the three systems, it will be readily seen that the system last described offers considerably greater advantages over the first and second, particularly for long cooling seasons, and it was decided to order two passenger cars to carry 24 passengers for the F.M.S. Railways, using this system.

Further consideration was given to the type of prime-mover for generating the electric current for the various parts of the plant. A scheme, using an internal combustion engine prime-mover was ruled out on account of possible danger from fire and vibration and the type finally decided upon was a mechanical drive by means of belts from the axle.

This plant was designed to provide for lighting as well as air conditioning and it was necessary and desirable that the existing standard train lighting voltage of 24-volts be retained. This was made possible by providing a generator to supply direct current at 48-60-volts for air conditioning plant operation and using a three-wire distribution system for the lighting.

Description of Plant and Cars

The complete equipment supplied with the first cars is shown in isometric view in Figure 4 and consists of the following principal components :—

(1) Generator and gear drive.
(2) Combined refrigerating unit containing the compressor and its motor drive and also two banks of condensers.
(3) Air conditioning unit.
(4) Control gear.
(5) Air distribution ducts.
(6) Precooling accessories, including an A.C. motor and plugs for obtaining both D.C. and A.C. current from outside Electrical supplies.
(7) Batteries.

As will be seen from Figure 4, the generator with its drive is housed on the underframe of the car, together with the batteries, the refrigerating unit and precooling accessories. The control panel (not shown in Figure 4) is situated inside the car whilst the air conditioning or evaporator unit is in the roof of the car.

The power required for driving the air conditioning equipment and supplying lighting is obtained from the carriage axle. Two axle pulleys and six vee-section rubber and canvas belts are used to drive a speed increasing gearbox mounted on a bracket on the car bogie headstock. This is shown in Figure 5.

The drive to the generator from the gearbox consists of a splined telescopic propeller shaft fitted with universal joints at each end. The generator is of 15 kilowatts capacity and is of the totally enclosed shunt wound type with commutating poles and fixed brush gear. The reversal of connections according to the direction of running is effected at the main control panel. A small alternator is overhung at the commutator end of the generator. This alternator is a simple machine with neither brush gear nor revolving windings and its output, converted to direct current by means of a bridge connected Westinghouse rectifier, operates the generator field contactor mounted on the main control panel in the car.

The combined type refrigerating unit is shown in Figure 6 and is mounted on the underframe of the vehicle in a framework which, when originally supplied, contained in a very compact mass the refrigerating compressor and its D.C. electric motor, the condenser in two banks, the liquid receiver and circulating air fans. The A.C. precooling motor is coupled by means of a splined shaft and universal couplings to the D.C. motor armature shaft. High and low pressure safety cut-out switches and pressure gauges are situated close to the compressor. The complete unit has a refrigerating capacity of 5½ short tons. The unit of refrigeration is defined as the amount of heat required over a period of 24 hours to convert one American or short ton of ice into water at the same temperature, and is equal to 288,000 B.Th.U.

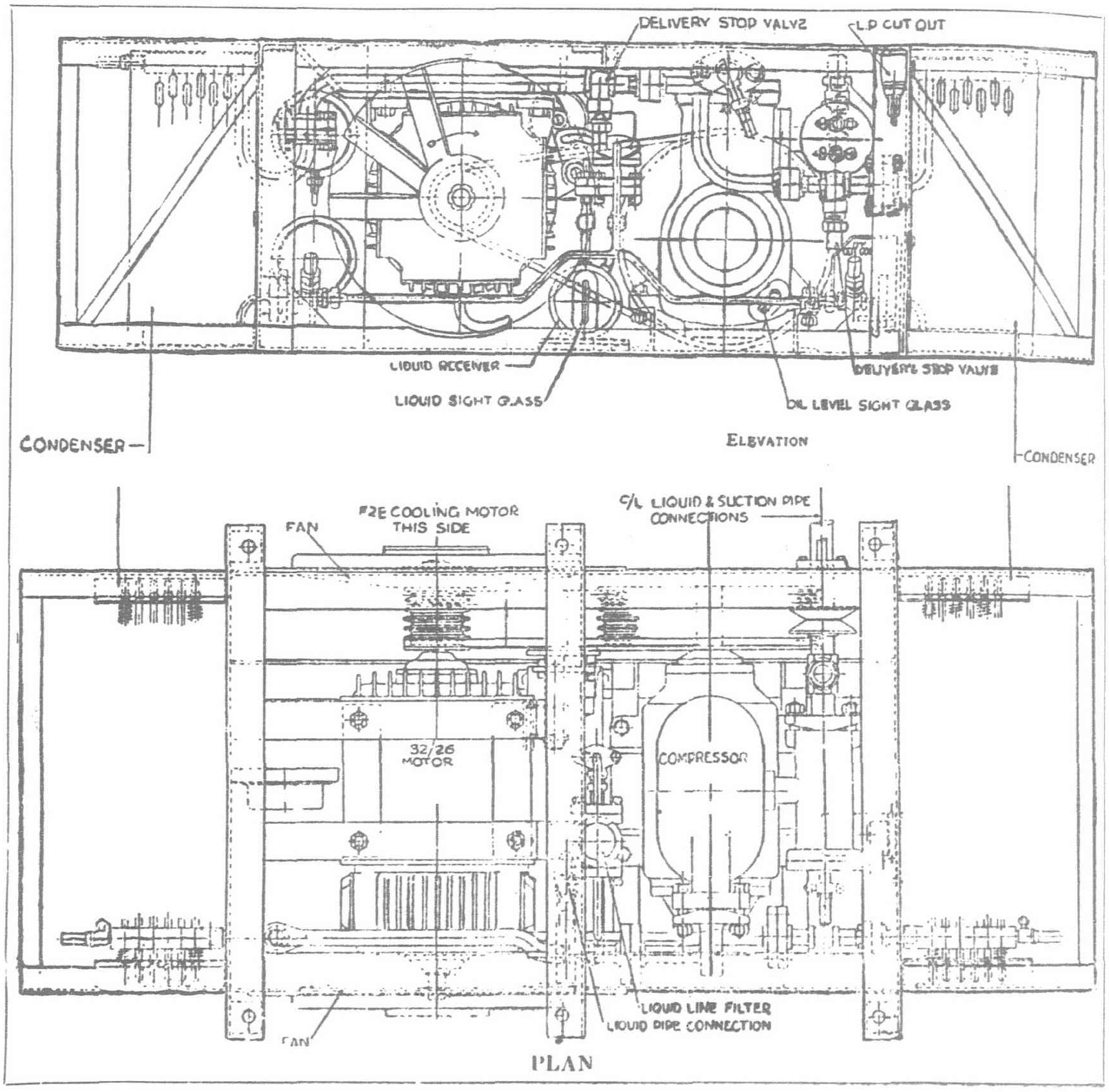


Fig. 6.—Combined refrigation unit

The combined type unit was altered for various reasons which will be described later in this paper, the condenser with its liquid receiver and fans being subsequently separated from the compressor and its motor drive.

The compressor is of the vertical single acting return flow twin cylinder reciprocating type arranged with splash lubrication. Lubrication of the compressor is effected by a specially refined straight anhydrous oil particularly suited to operation with "Freon."

The air conditioning unit, which is situated in the roof, is shown in Figure 7. It consists of a light welded steel framework containing an evaporator or expansion coil, two centrifugal air circulating fans and a totally enclosed electric motor. Fresh air filters of the viscous type are mounted on the air inlet side to the air conditioning unit.

The entire electrical equipment is controlled from the main control panel accommodated in a cupboard conveniently situated in the car adjacent to the air conditioning unit. This is the only part of the plant which occupies passenger space. Fully automatic and manual control is provided on this panel, the master control panel being mounted immediately in front of the main panel. The master control panel is shown in Figure 8.

Mounted on the main panel are :—

(1) Generator field switch rectifier for converting the A.C. output of the inductor alternator to direct current for operating the field contactor of the main generator.
(2) Dynamo current and voltage regulator.
(3) Auto cut-in relays for operating the cut-in contactors which connect the generator to the batteries.
(4) Selective rectifiers for the operation of the cut-in contactors for either direction of train travel.
(5) Lamp voltage regulators.
(6) Automatic starting and control gear for the compressor D.C. motor.
(7) Low voltage relay for disconnecting the supply should the voltage fall to a dangerously low figure.
(8) Air conditioning unit fan motor contactor for starting the fan motor.
(9) Field discharge condenser for suppressing the arcing at the field switch contacts during breaking.
(10) Contactor for controlling the lighting circuit.
(11) A.C. precooling contactor.
(12) Low voltage relay rectifier.

Fresh air from outside the car is drawn through the viscous oil filter unit by means of a fan and is mixed with a proportion of the air from inside the car. This then passes over the cooling coils of the roof evaporator unit and is cooled and de-humidified and delivered through a main center duct fitted with adjustable outlets into the car. A proportion of the air escapes to atmosphere through exhaust air grilles fitted in the sides of the car whilst the remainder is mixed with the incoming fresh air and recirculated. The exhaust air grilles permit not less than 25 per cent of the air to escape from the car, so that an equivalent quantity of fresh air enters to make up the deficiency. The total capacity of the fan unit in the evaporator varies from 1,200 to 1,450 cubic feet per minute.

Thermal control is effected by the use of a manually set thermostat of the mercury tube type with three temperature settings.

Arrangements are made to operate the air conditioning equipment by plugging into an alternating current supply at terminal stations where this is available. This operation saves the heavy drain on the batteries which would naturally follow when the cars are stationary. Plugs for operating on D.C. were installed also in these cars, but owing to the more uniform standard A.C. supplies

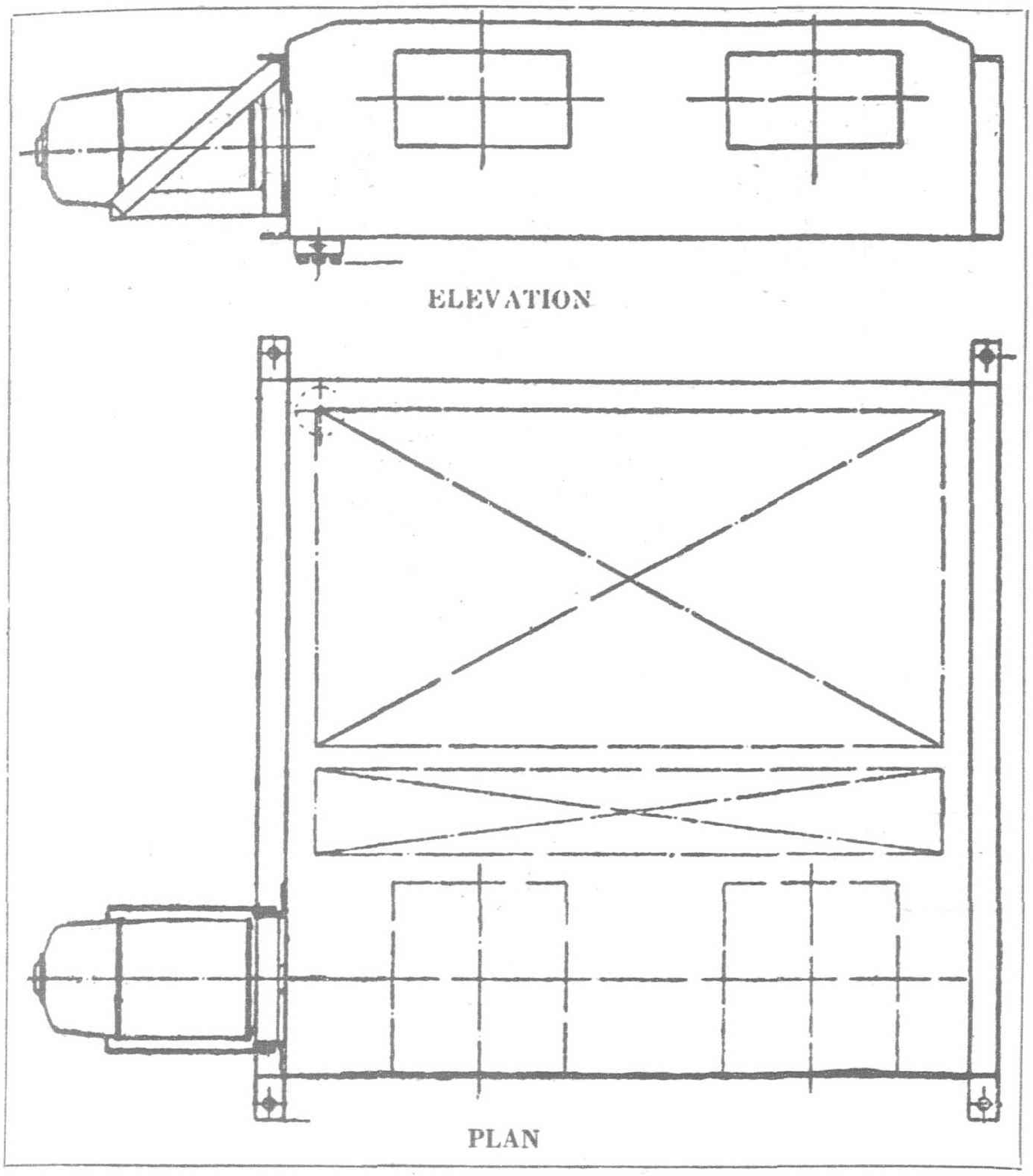


Fig. 7.—Air conditioning unit

being available, the D.C. equipment has never been used and has now been removed. When the A.C. plug is inserted it energizes the A.C. line contactor which, in turn, allows the alternating current to operate the 17.5 h.p. - A.C. motor. This, as previously mentioned, is coupled by means of a splined shaft and universal joints to the D.C. compressor motor armature shaft.

Pilot pins in the A.C. plugs make contact when the precooling plug is nearly " home " and the A.C. contactor coil and the control circuit in the D.C. compressor motor are coupled to the battery supply. This enables the D.C. compressor motor to operate as a generator for charging the batteries and at the same time places the A.C. motor under the control of the high and low pressure safety cut-outs and the thermostat. The A.C. precooling motor is protected against overload by a thermal overload relay, which operates to interrupt the D.C. supply to the A.C. line contactor, and to isolate the motor from the A.C. supply.

Special lightweight type batteries are installed for this work, the cells of which are designed to give the maximum output for a given weight and have a particularly low internal electrical resistance. They are thus capable of sustaining heavy rates of discharge for short periods and will absorb high rates of charge at comparatively low potentials, so that charging can be carried out both quickly and effectively. The capacity of each of the batteries supplied with the cars was 520 ampere hours. It was found subsequently that this capacity was insufficient for the heavy duties which they were called upon to perform and units of 720 ampere hours capacity were substituted.

It was decided to undertake complete manufacture of these cars in England, in view of the new problems associated with their design. The manufacturers adopted an all-steel design of car using the bodies as girders for the purpose of supporting the underframe equipment. It was thus possible to obtain more space under the bodies for the accommodation of the air conditioning plant as it enabled the longitudinal underframe members to be made correspondingly shallower and lighter.

The adoption of an all-steel design required a very thorough heat insulation and special attention was paid to this. These coaches are completely lined with cork slabs of 1-in. thickness on the roof, sides and floor.

The distribution of air in the cars deserves special mention. This is carried out by two ducts running down the center of the coach six inches apart. A cross-section of the roof showing these ducts is given in Figure 9. Air is delivered from slots in their sides to the center space bounded by the ducts and small hinged dampers are fixed over the slots to regulate the air delivery. The air then passes into the compartment through grilles. This method of distribution has been superseded in new coaches now under construction.

The window dimensions of the coaches were limited by the Makers of the air conditioning plant. Although double windows and blinds are provided, solar radiation can and does produce a very heavy heat load on the plant.

Provision has been made for the opening of certain of the double windows in the event of the complete breakdown of both air conditioning plant and ventilating fans. It will be appreciated that the opening of windows in such circumstances has a deleterious effect upon the interior appointments due to the infiltration of dust and it is fortunate that the occasions have been rare when such action has become necessary. In order to provide for a fresh air supply in the event of the cooling plant failure, the ducts through which the recirculated air passes to the roof evaporator unit are blanked off, one of the outside doors is opened and the ventilating fans thus supply 100 per cent fresh, clean air.

Tests

Prior to the dispatch of the cars, tests were carried out on them at the Car Body Builders' Works. A temporary shed was built round the cars and Malayan temperature and humidity conditions were simulated by controlled steam jets blowing into the shed.

The cars were shipped out on deck to Malaya. One of these unfortunately was damaged due to heavy seas in its passage out, and considerable trouble was experienced in the first few months of its working due to seawater having affected the electrical gear.

Numerous tests were carried out locally before they were placed in public service and representative graphs showing average temperature and humidity conditions during these tests, are shown.

Modifications in Design

These coaches had been working some months when it became necessary to reconsider the design of the air conditioning plant.

Prior to this, a considerable amount of trouble had been experienced with the compressor drive. The six vee-section canvas and rubber continuous belts comprising this required changing far too frequently and when removed, were found to have failed in almost all cases by thinning down at one point and stretching excessively. It was thought at first that the belt tightening jockey pulley was at fault and this was altered. Trouble continued, however, and new pulleys were then manufactured to accommodate an additional belt and further improvements made to the belt tightening arrangements. A slight improvement was obtained and in the meantime, other causes were sought for the heavy slipping. The delivery pressure from the compressor had been found to be consistently high and many experiments were carried out in an endeavor to reduce this. The trouble experienced with the belts was directly traceable to the high delivery pressure as the high torque required to start up the compressor from rest caused the belts to slip on the driving pulley. Improvements were made to the air cooling arrangements on the condensers which effected a reduction in the delivery pressures. These consisted of the fitting of collars around the inlet air casing to the fans and alterations in the disposition of the air flow over the condenser coils. The results of these experiments are graphically shown in the diagram.

The conclusion was finally reached that the fault lay in there being insufficient condenser capacity for conditions prevailing in this country. Whilst the unit containing the compressor, motor and condensers had obvious advantages in space saving, the fans fitted on the compressor motor could not, owing to the peculiar construction of the unit, effectively deal with the cooling. The Makers of the plant therefore collaborated with the Railway Administration and supplied new self-contained and separate motor driven fan cooled condensers of larger capacity. An examination of Figure 10 shows one of the condenser units.

An opportunity was taken also of changing A.C. squirrel cage precooling motors for slipring motors, and of removing the switch-gear for this from the main control panel. The 400-volt contactor switchgear for the A.C. slipring motor was placed on the underframe and is entirely separated from the 48-volt D.C. main panel. The first car to be so converted has been working about two-and-a-half months and the second one has been in service about one month and the results have been entirely satisfactory. Reference again to the diagram of condenser pressures shows the effect of improved heat exchange.

Further alterations which have improved conditions in the cars included the fitting of diffuser panels below the outlet grilles in the roof. These have reduced the relative humidity in the cars due to the additional heat obtained from the warmer roof surfaces over which the air is now constrained to move. Further reference to Figure 9 shows the position of these diffuser panels in relation to the outlet grilles. Filters were fitted also on the recirculated air ducts leading to the roof unit, as although all incoming fresh air is efficiently filtered it was found that over a period of a few months' working, the main ducts carrying the cold air contained large quantities of fluffy material and dust which had been collected from carpets, etc.

A further graph of temperature and humidity conditions in one of these cars taken after these conversions and modifications, is shown.

New Air Conditioned Cars

The Railway Administration has now under construction three Buffet Cars, three Day and Night Cars and two Restaurant Cars, all of which are to be air conditioned and which, when completed, will bring the total number of such cars in service to ten.

The experience gained with the first two cars has been extremely valuable in arriving at satisfactory designs for the new ones. The underframes and air conditioning plants have been obtained from England, whilst the steel panelled bodies have been designed and manufactured in this country. Teak and local timbers have been used largely in their construction.

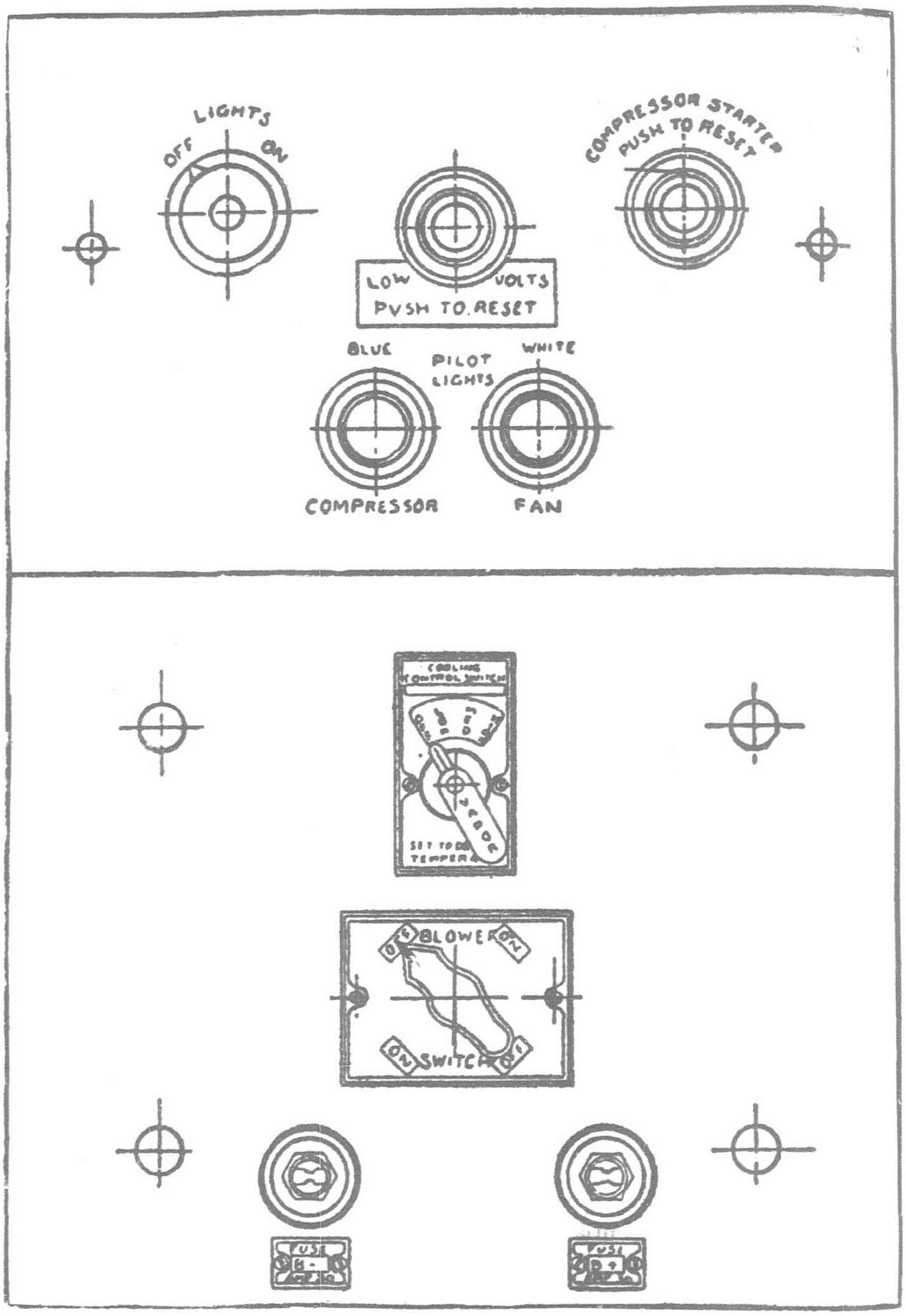


Fig. 8.--Master control panel

The design of the air conditioning plant is almost similar to that of the modified plants installed on the first two cars. In order to obtain accommodation on the underframes it has been necessary to offset the generator from the center line of the car and this is driven by a set of vee rope belts through the splined shaft and universal combined belt and gear drive as adopted previously.

Figure 11 shows the roof section and arrangement for distributing the air from the evaporator unit in the roof for open and compartmental type cars. It will be noted that this form of distribution differs considerably from that of the first cars shown in Figure 8 and has been adopted on account of its greater efficiency. The cool air in passing over the large surfaces of the interior roof duct absorbs extraneous heat, thus reducing the relative humidity of the air delivered to the interior of the cars without absorbing more power.

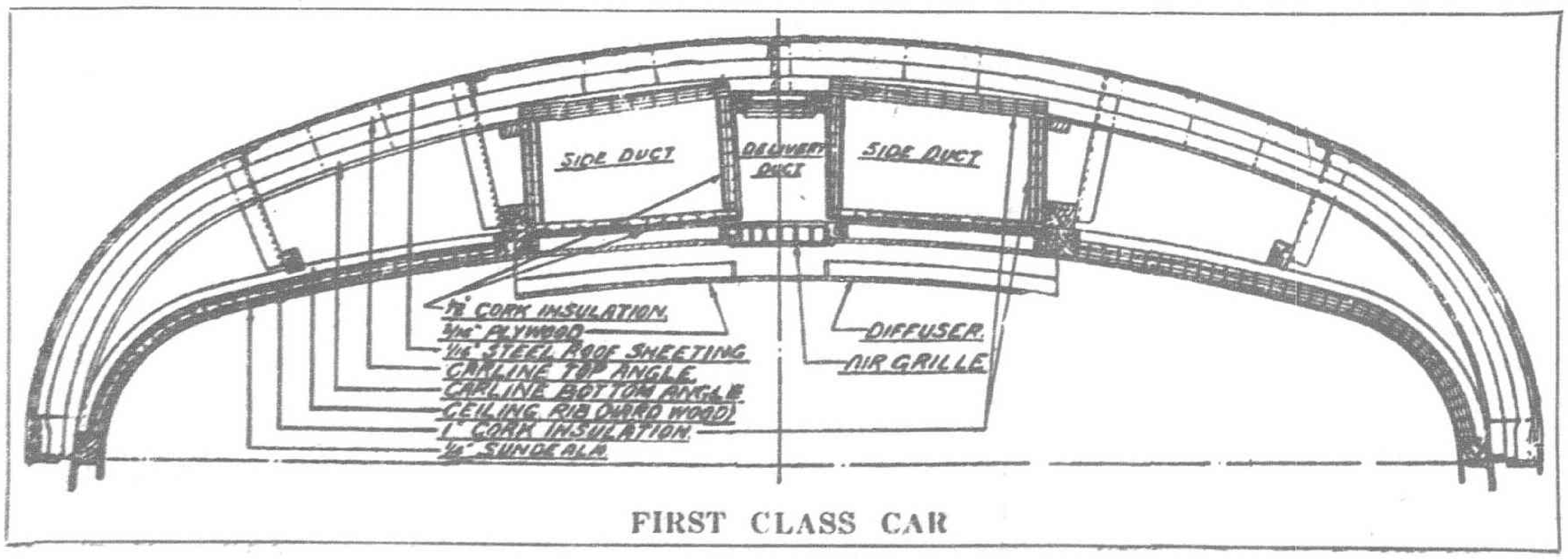


Fig. 9.—Roof section

It will be noted on reference to Figure 11 that the air is deflected by means of a small deflector on egress and the volume of air delivered is varied by means of a small metal strip fixed behind this deflector. It is intended that the air should have just sufficient velocity at egress from the roof duct to cause it to rise a short distance along the interior roof of the vehicle before it falls due to its greater density.

It is essential that the distribution of air in a car be such that there are neither cold nor hot pockets. So important is this that a difference in excess of two degrees between the average temperatures at various points in a car is considered to be most undesirable. It is not only important to have a small difference in temperature on any horizontal level, but at other levels as well. The average temperature at ankle level, for instance, should not be more than one degree lower than that at head level when the passenger is seated.

In the case of the Buffet Cars and Restaurant Cars, separate domestic type electric refrigerator compressor units have been fitted on the underframes for operating eight cubic feet capacity domestic refrigerators. These cars have been fitted also with special air seals at doors leading from the air conditioned space which are frequently opened by the train and kitchen staff. A fan draws conditioned air from the roof section and discharges it at a high pressure through slots in a duct on both sides of the door openings. The Buffet Cars have a seating capacity of 18, whilst the Restaurant Cars will seat 12 each in the lounge and dining portions respectively.

With regard to the day and night cars, automatic water-raising equipment has been fitted, consisting of a small electrically driven air compressor which maintains a constant pressure of air above the water contained in the underframe tanks. This is sufficient to produce an appreciable head at the water taps for toilet, bathroom and lavatory services.

The day and night cars are equipped with eight single compartments for night use and will carry 24 passengers when engaged on day service.

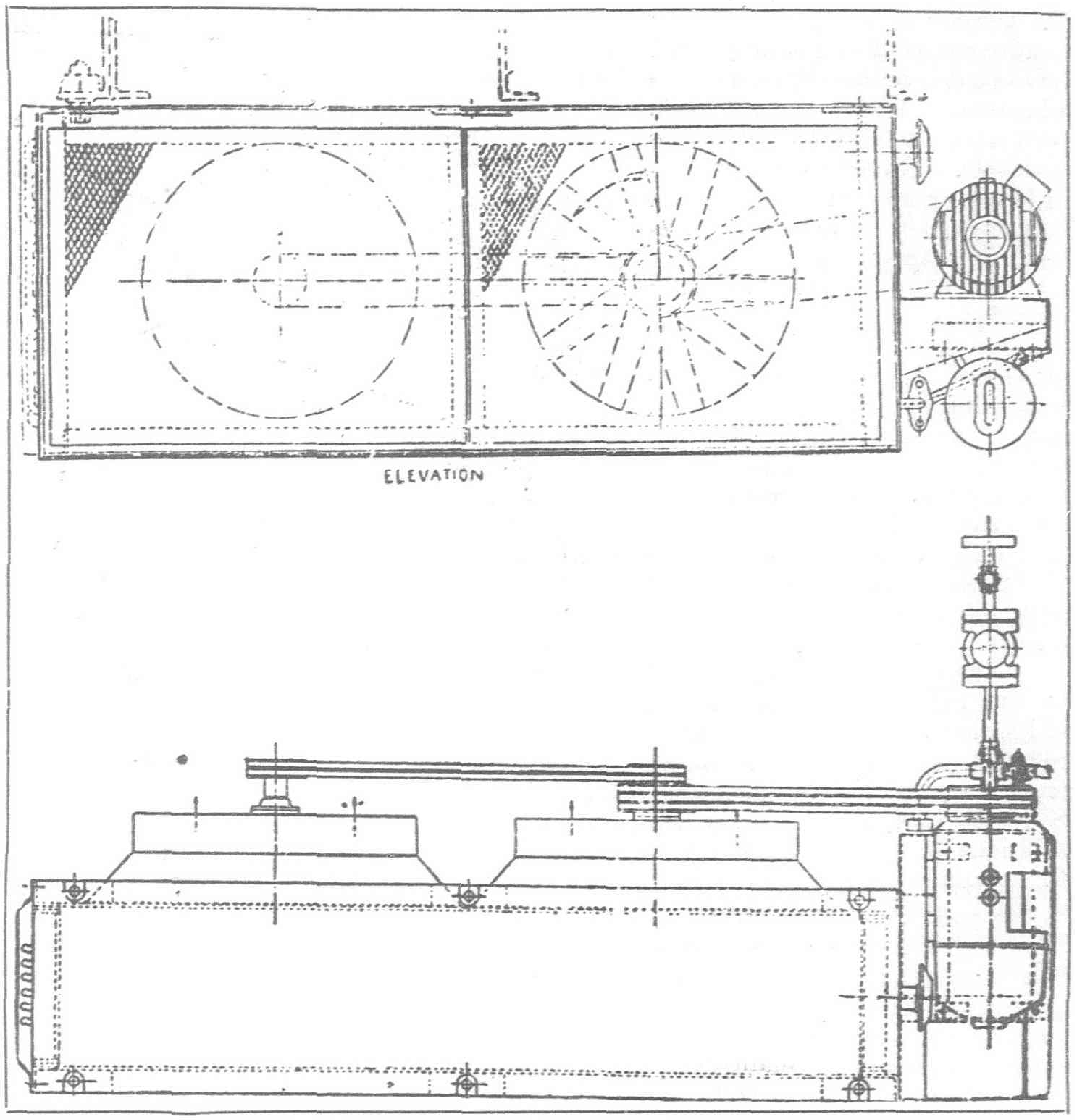


Fig. 10.— Condenser unit

The author has been unable to place before this meeting the results of tests carried out on the new coaches, but preliminary test indicate that they will be entirely satisfactory in service and more efficient than their predecessors.

General

This paper would not be complete without some general observations on the essentials of air conditioning.

Considerable divergence of opinion exists on the subject of what constitutes a satisfactory temperature and relative humidity for comfort air conditioning, and in this connection, it is interesting to quote from a census carried out by the Division of Equipment Research Association of American Railroads. At the time tests were being carried out on cars by the above Association, each passenger was given a card on which he was requested to comment on his reactions and, out of a total of 64,814 comments, 95½ per cent commented favorably, whilst the remainder, amounting to 2,822, commented as follows :—

	No. of comments	*Percentage of total comments*
Much too warm	75	2.7
Slightly too warm	505	17.9
Much too cool	51	1.8
Slightly too cool	530	18.7
Clammy	113	4.0
Stuffy	240	8.5
Drafty	197	7.0
Noisy	196	6.9
Too cool upon entering	205	7.3
Objectionable odour	140	5.0
Excessive tobacco smoke	135	4.8
Too much heat from sunshine through windows	435	15.4
	2,822	100.0

Information on such lines has not been obtained so far concerning passengers' reactions to air conditioning in this country, but as its use will be extended by the new cars going into service, an early opportunity will be taken to do so.

Knowledge regarding the effect of humidity on health is limited. Most people are unable to detect relative humidities between 30 and 60 per cent within a desirable range of temperature. Above 70 per cent there is a feeling of dampness whilst below 30 per cent a dry sensation is experienced in the nostrils and throat. It is generally held that the desirable range of relative humidity in a passenger car should be between 40 and 60 per cent. It is extremely difficult in Malaya to maintain such figures consistently within a comfort range of temperature, particularly during the night hours. Automatic control of humidity would be a very desirable feature of passenger car air conditioning but, so far as is known, reliable apparatus for such control has not been manufactured commercially. Thermal control presents no great difficulty although it is the prevailing opinion that entire satisfaction will not be obtained until a modulating automatic control is used. Control system of this type are being manufactured and are in use on a few of the American Railroads. It is understood that this system regulates the amount of refrigeration to suit requirements either by thermostatically controlled dampers, by varying the speed of the refrigerator compressor motor, or by special modulating valves on the evaporator coil.

The important subject of air distribution has already been dealt with and it is appropriate here to mention that its speed of movement is equally important. Should this rise to any greater speed than 75 feet per minute, it becomes obtrusive and, in certain cases, is a source of discomfort.

Mention as been made that approximately 25 per cent fresh outside air mixes with 75 per cent returned cooled air for recirculation when the plant in these cars is working normally. Thus, when they are loaded to capacity the volume of fresh air supplied per person per minute varies from about 15 in the case of the day cars to as much as 45 for the night cars. Some divergence of opinion exists as to the proper amount of fresh air which should be added, but a figure of ten cubic feet per minute per passenger is considered by most authorities to be adequate. Where smoking is permitted, a larger amount is desirable. Travellers by air conditioned cars on the F.M.S. Railways may be assured, therefore, that their supply of fresh air is above that normally provided.

An important advantage of air conditioning passenger cars is cleanliness. This is appreciated almost as much as a desirable temperature. Filtration of all air is indispensable to a satisfactory air conditioning system and is not only important from the viewpoint of cleanliness but has some effect on the prevention of odours.

Odours are usually confined to the results of smoking, and unless air filtration equipment is regularly and frequently attended to, these become objectionable. Some Railways use deorderant solutions in sprayed form in an attempt more to mask than to neutralize odours. It is of interest to note that, except for a short period following the first few weeks' service of the original cars, the F.M.S. Railways have had no trouble in this respect.

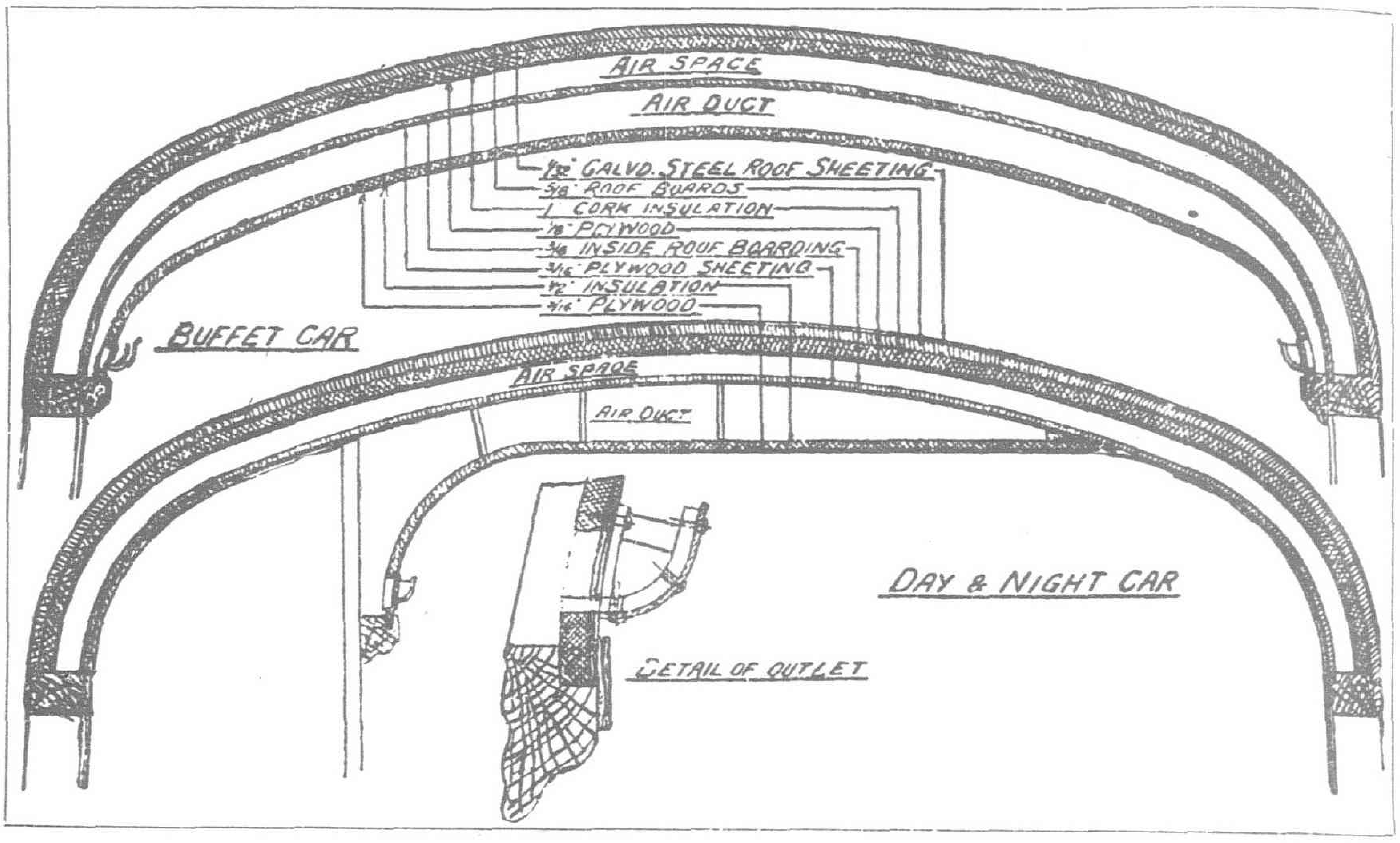


Fig. 11.—Roof sections

In conclusion, the author wishes to record his thanks to the General Manager, Railways, for permission to give this paper, to Messrs. J. Stone & Co., Ltd., the Manufacturers of the equipment, and the Association of American Railroads for the use of certain data and diagrams in its compilation.

The O'Ryan Survey

(Continued from page 280)

European markets, hesitate to explore the rich Far Eastern field because of lack of information or the prevalence of so much confusing misinformation.

What Major-General O'Ryan's report will reveal will not be known until the Japan Economic Federation chooses to make it public. The American during his travels declined to make any statement, reserving comment for the written report. He did, however, emphasize his desire to see the end to Sino-Japanese hostilities.

If the reports of other unofficial and possibly less-qualified observers are any criterion, it is likely that the survey will show the presence of huge marketing possibilities throughout the Far East. Building materials, structural steel, rough and finished iron and steel products, machinery, rails and rolling stock, lumber and other allied materials are extremely scarce, to cover only a small field. In Japan and Manchoukuo, building projects of long standing have been suspended, and new construction work is almost at a standstill. In China reconstruction work is delayed by this shortage.

One can see in Hsinking, Manchoukuo, how the ambitious building scheme begun a few years ago has been slowed down. While most of the necessary government buildings were completed some time ago, there are numerous lots, already purchased by large firms as building sites, which remain unoccupied because of the shortage and high cost of construction materials.

There are reports too of the strain to which rolling stock has been put in meeting new load demands without sufficient replacement and up-keep. The rapid development of Manchoukuo has resulted in construction of new lines and spurs into young country which took much of available materials, while the up-keep of older lines has had to wait. If materials were more abundant, it is certain, observers declare, that expansion would progress at a far faster rate. In the same vein, traffic has become so heavy on many Manchoukuo and North China lines, both passenger and freight, that double-tracking is necessary. While these instances refers only to specific fields, the O'Ryan survey is all-inclusive, it is understood.

It is not known whether Major-General O'Ryan's survey is merely a fact-finding mission, or whether he will make specific recommendations to his sponsors on how to improve trade relations between Japanese and American importers and exporters. He has been quoted as saying that while rapid changes in the near future may not be expected, strained relations between Japan and America will improve.

Other members of the party were Dr. Simon Whitney, economic adviser to Edie and Company, investment brokers in New York City, and former associate economist of the Chase National Bank; Dr. Warren S. Hunsberger, professor of economics at Princeton University; and Mrs. Ganna Mahrt Syro-Boiarsky, secretary to Major-General O'Ryan.

Fast Diesel Railcars in Belgium

(Continued from page 288)

work. Fig. 16 shows the lay-out of the Louvain workshop. In Fig. 17 is shown a view of this workshop where numerous Maybach Diesel engines of the Belgian National Railways are cared for. At the end of 1939 they totalled:

20 150/175 b.h.p. Maybach six-cylinder engines
2 210 b.h.p.
12 410/450 Maybach twelve-cylinder engines.
16 600/650 ,, ,, ,, ,,

A special feature of these workshops are the distribution tables with covers forming double desks, as shown in Fig. 17. These make it simple to survey the repair work. Overhaul of the railcars is carried out following a monthly schedule For the simple railcars with a monthly mileage of about 10,000 km. (6,200 miles) the repair schedule requires the following times of immobilization:

For weekly overhauls, One working day.
For half-yearly overhauls, six working days (partial inspection).
For annual overhauls, twelve working days (main overhaul).

In view of the great mileages the three-coach railcars have to cover a partial overhaul every three or four months, and a main overhaul every six or eight months is deemed necessary. Besides this, a complete overhaul of the coach body is made every two years. The periods when railcars are withdrawn from service under this schedule are as follows:

Weekly overhaul, less than one working day.
Every 3 to 4 months, six working days.
Every 6 to 8 months, 25 working days.

Economic Phases of World's Output of Fuels and Metals

By *JAMES A. RABBITT*

[*The following is from an address given by the Author at a meeting of the Nenyo Kyokai (Fuel Society) at Nippon Kogyo Kaikan (Japan Institute of Mining) at Tokyo on December 9, last. Mr. Rabbitt is Advisor and Director of The Japan Nickel Information Bureau at Tokyo*].

* * *

As stated by Hoover in his excellent book, on the Economics of Mining, "our present civilization is based upon an increasing demand for, and utilization of, mineral deposits. The structure of this civilization is like that of the steel sky-scraper ; its pace is that of a machine of metal, fed by mineral fuel."

Thus, we have metals and fuel linked in one of the most vital phases of our industrial civilization, and as pointed out by Dr. Yoshikiyo Oshima in his recent editorial "metals and fuel are so interdependent that any study which results in an economy for one is bound to react favorably on the other—to the nation's advantage."

In this paper there is given an outline of the production of fuel and metal in relation to consumption and control together with some practical specifications for economy in the processes of production, refining and combustion of oil, gas and coal.

To keep our metallized civilization in motion requires about ninety million tons of pig iron and six million tons of non-ferrous metals yearly.

Fuel is Major Factor

In the processes of obtaining, refining and utilizing this vast quantity of metal, fuel is the most important factor. Stated more definitely, it is necessary to produce annually, 1,157 million tons (1936) of coal (including Japan) 40,000,000 and 85,512 million gallons (1937) of oil for furnishing the power necessary to bring the ores from the mines, smelt and refine the metals, transport them, and put the machinery which they produce into motion. Here we have metals depending upon fuel, but this does not complete the picture ; it is also necessary for fuel to depend upon metals in its mining, transportation, refining and utilization.

Until comparatively recent times, the bulk of this vast quantity of metals and fuels was consumed in a few sections of the world known as industrial countries. The spread of industrialization, however, has upset the old relationship between the per capita consumption of metals and of fuels.

American Consumption

For instance, in the United States in 1850, the average person used about half a ton of coal and 55 pounds of iron per year ; in 1910, each person in the United States used about five tons of coal and 665 pounds of iron ; and in 1929, each person used about five tons of coal and 788 pounds of iron. It will be noted that between 1910 and 1929, the consumption of coal per capita remained static, while the consumption per capita of iron advanced. But during this period the consumption of oil per capita had (in U.S.A.) advanced from 87 gallons in 1910 to 340 gallons in 1929 and to 408 gallons in 1937.

At the present time we are in the midst of an industrial revolution, due largely to the spread of technical knowledge by industrial countries, as well as the shipment of their products throughout the world, which has resulted in a desire on the part of the rest of the world to share in the fruits of the industrial civilization created by these pioneer industrial countries.

Countries which heretofore have been classified as philosophical have become scientific and wish to surrender the old dogma of peace and contentment for the new creed of material activity.

Consequently, they are not only reaching for the products of industrial countries but now wish to participate in the production of mechanized appliances for their own convenience and satisfaction. What will happen when the balance of the 1,740 million people in the world advance to a per capita consumption of fuels and metals equal or approximating that of the 120 millions in the United States, is a problem that startles the imagination and imposes a great burden upon each individual engineer who is responsible for specifying the use of even one ton of the precious fuels or metals which have now become the cornerstone upon which our present day civilization rests.

The supply of minerals required up to the present time has been obtainable by comparatively shallow operations, but henceforth it will be necessary to go deeper and deeper into the earth's crust in order to satisfy the demands of this revolving world. Each additional thousand feet we penetrate underground in search of minerals involves a multiplicity of metallurgical problems to take care of the additional weights due to increased length of cables in mine hoisting equipment or to increased length of rods in oil drilling, all of which requires a greater development of lighter and stronger alloys to meet these extra loads.

In surface or aerial transportation, there are new problems due to increased speed and reduced weight which are taxing the intelligence and energies of metallurgists throughout the world.

Each of these changes affecting metals has also reacted in a similar manner on fuels to meet the necessity for higher powers to obtain greater speed with less weight. Therefore, we are faced with a group of converging problems which involve the fuel engineers as well as the metallurgists, whose labors must be coordinated to furnish the required solutions.

At this point I wish to quote again from Hoover in connection with the control of mineral waste : "The waste in mining some minerals is large, notably in the case of fuels (coal, about 50 per cent and petroleum, perhaps as much as 80 per cent) ; the mining loss of non-ferrous metals is much less. The waste of metallurgical recovery from these ores, after they have been brought to the surface, is very small ; every device of the metallurgist is used to recover the last possible ounce of metal from the ore.

Waste in Consumption

"The waste in metal consumption—which does not include unavoidable destruction such as the utilization of large quantities of lead and zinc in chemicals and pigments and non-corrosive coverings, but rather waste through sheer extravagance and dissipation—is estimated to amount to about one-tenth of one per cent of annual production. This does not look to be an alarming fraction until one recognizes that it represents a hundred thousand tons of metal a year, which is probably more than the human race had in its possession up to the beginning of the Christian era."

The economic responsibility of the fuel engineer is as great, if not greater, than that of the mining and metallurgical engineer in this field, with the added difficulty of covering the very wide range of engineering activities.

The fuel engineer is not only responsible for the production of fuels sufficient to meet the constantly increasing demands, but is also responsible for refining, transportation, and finally, the economic combustion of his product.

As has been pointed out by Hoover, the waste in mining coal is about 50 per cent and petroleum probably as much as 80 per cent. In addition to this, we might add that up to quite recent times the waste in combustion was equally as high.

Thanks, however, to improvements in design by the coordination of the metallurgical, fuel and mechanical engineers, great advances have been made in the economy of combustion so that the efficiencies known only thirty years ago of 50 per cent in the old fire tube boilers, slide valve steam engines and the two cycle gasoline engines are to-day practically unknown, having been replaced by new designs capable of using more highly refined fuels, so that efficiencies of 95 per cent in the most modern coal power units and higher in explosive engines are common in some countries.

If complete economy is to be obtained, these improvements must become universal to a point where it will be unpatriotic or an act against the national economy in any country to use any but the most advanced methods and most highly developed alloys for applying such methods in the production or consumption of fuels or metals.

Million-Dollar Electrical Export Markets—Philippine Islands

By BERNARD I. FEIG

(U.S. Commerce Reports)

AMONG Far Eastern markets, American electrical manufacturers and exporters find their best outlet in the Philippine Islands. Trade between the Philippine Islands and the United States has been characterized, since 1909, by a reciprocal free trade arrangement which accords mutually free customs entry to each country's products. This procedure accounts for the dominant position of American merchandise in the Philippine market.

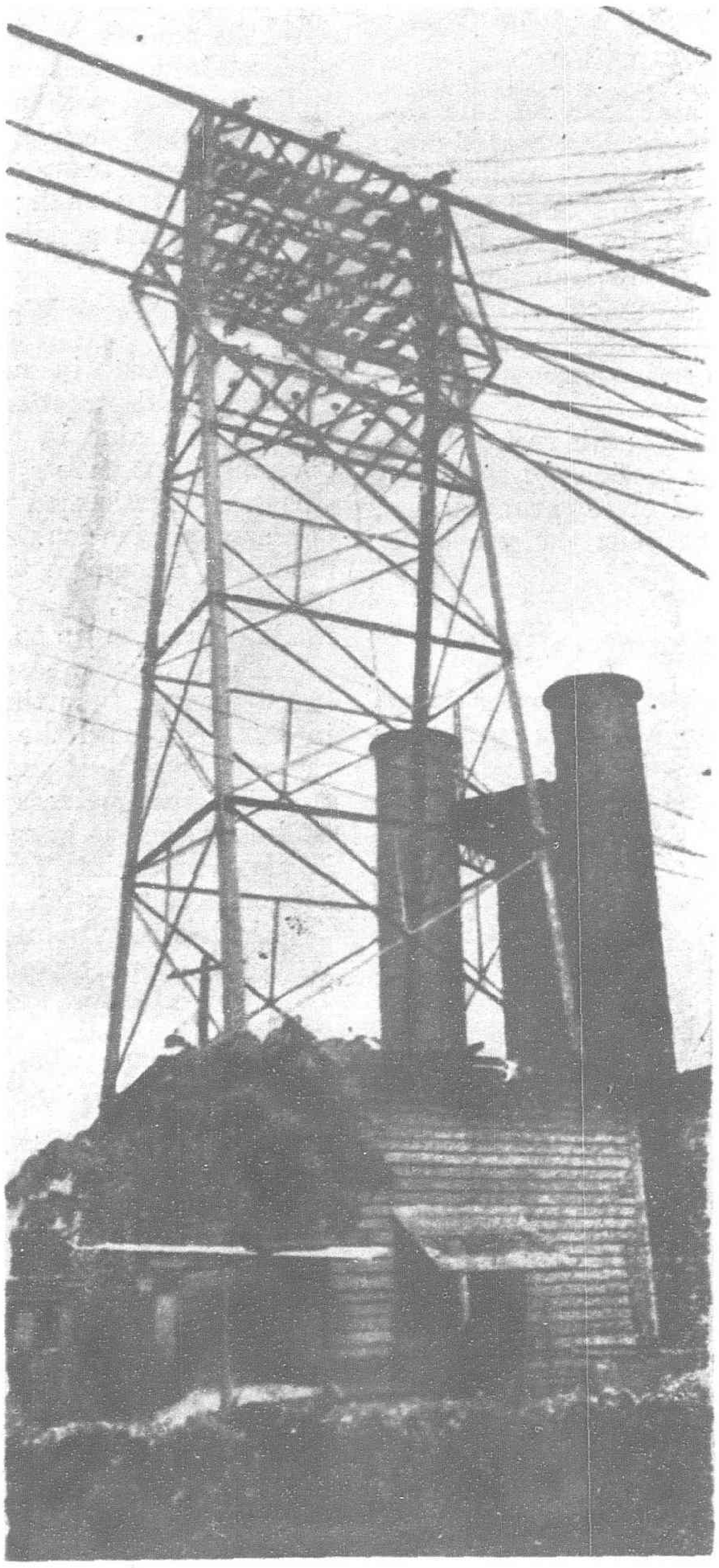
American electrical machinery and apparatus comprise approximately 85 per cent of that country's electrical imports. Aside from the advantages stemming from free trade, American electrical products derive added competitive strength from such other factors as the Flag Law, which provides price concessions to American manufacturers who participate in bidding on Government projects, and the fact that many Filipino engineers and technicians have been educated along American lines has made for a fairly general acceptance of and preference for American electrical standards and equipment.

The three-year period under specific consideration—1936-38—witnessed the greatest aggregate volume of business of any similar period in the history of the electrical trade between the two countries. Although they constantly exceeded the million-dollar mark each year, American electrical shipments to the Philippine Islands reached an all-time high of $3,533,654 in 1937, an advance of approximately 45 per cent over the preceding year's total of $2,444,016, and somewhat higher than the 1938 figure of $3,259,021.

The Philippines are composed of more than 7,000 islands among which is distributed a population of 16,000,000 whose standard of living, measured by oriental standards, is relatively high. The country's economy is primarily agricultural and, therefore, does not offer extensive opportunity for the use of electricity or electrical machinery. The topography of the country is also a deterrent to more widespread electric current distribution and is an important factor in the relatively high rates charged for electric energy.

Nevertheless, some of the larger commercial centers are making increased use of electricity, and electric power production has been gaining slowly but steadily. The rapid expansion of mining enter-prises during recent years has accounted for a good portion of the increased electrical imports, since mine operators have been utilizing increasingly larger quantities of both electric power and machinery in order to increase their productive efficiency.

A building boom, which continued unabated during the period under review, was also materially responsible for the large imports of electrical equipment. This building activity was participated in by both public and private interests and helped considerably to sustain the general purchasing power of the Filipinos. Various types of Government works projects also helped a great deal to offset the depression that might have been engendered by the exceedingly low returns for Philippine export products, particularly in 1938.



High Line, Manila Electric Company at Manila

Value of American Exports, 1936-38

Following is a detailed table of United States exports of electrical equipment to the Philippine Islands, only those items being separately listed the annual sales of which exceeded $100,000 in any of the three years shown.

UNITED STATES EXPORTS OF ELECTRICAL EQUIPMENT TO THE PHILIPPINE ISLANDS

(Value in thousands of dollars)

Commodity description	*1936*	*1397*	*1938*
Transmitting sets, tubes and parts ..	96	152	93
Radio receiving sets	181	301	250
Other radio receiving apparatus ..	59	100	81
Telephone instruments and apparatus ..	121	367	294
Flashlight batteries	180	219	167
Stationary motors, 1-200 h.p.	76	121	138
Rubber-covered wire	204	237	255
Other insulated copper wire and cable ..	59	220	173
Electric household refrigerators . ..	197	141	208
Electric incandescent light bulbs ..	92	114	94
Other electrical apparatus.	1,179	1,562	1,506
Total	2,444	3,534	3,259

Radio Apparatus

Owing to the free customs entry accorded them, American electrical exports strongly predominate in every line. American radio apparatus satisfies approximately 95 per cent of the country's radio requirements, encountering only negligible competition from the Dutch Philips product. Domestic manufacturing does not exist, although there is a small amount of local assembling of imported parts. Expansion of broadcasting facilities and prosperous economic conditions accounted for the gratifying increase in radio apparatus sales in 1937. In 1938, however, there occurred a decline in purchasing power in line with the lower returns for Philippine products, and radio imports fell off somewhat. Nevertheless, prospects for increased radio sales improved considerably in 1939 when the radio registration tax was materially reduced. In fact, radio registrations in 1939 ran well ahead of those during the preceding year.

The notable advance in telephone equipment imports in 1937 was occasioned by the installation of a new system in Davao, but subsequent lack of new projects brought about a reduction in the demand for such materials in 1938. There remains, however, considerable field for future development and expansion of telephone facilities on the islands, so that American manufacturers of such equipment can look forward to added business in the future.

The Sino-Japanese conflict eliminated practically all of the competition with which American flashlight battery manufacturers had been faced, and which had emanated chiefly from Chinese sources. After a notable increase in 1937, imports of flashlight batteries dropped off considerably the following

(Continued on page 303)

The Principles of Drag-Suction Dredging[*]

The Drag-Suction Dredger "Chien She"

By *HERBERT CHATLEY*, D.SC. (ENG.), M.INST.C.E.

(The Dock and Harbor Authority)

(The Author Formerly was Chief Engineer of The Whangpoo Conservancy Board at Shanghai)

In the Author's Paper "Energy Considerations in Dredging"[†] reference was made to the mechanical conditions of drag-suction dredging, based on a study of the available date extending over ten years. Since writing that Paper, the largest drag-suction dredger in operation (the *Chien She*[‡], working in the Yangtze Estuary) has been built by Messrs. Schichau of Danzig and Elbing, for the Whangpoo Conservancy Board to the writer's specification, and has been working successfully on the entrance bar of the Yangtze River since the summer of 1935. The annual output is over 5,000,000 cu. yds. of in situ material. Just completed is a second and rather larger dredger (the *Fu Shing*), which is provided with additional propulsive power, water-tube boilers and cylindrical dumping valves[§].

The design and operation of the dredger *Chien She* involved the investigation of various matters concerning which little information was available, and it is hoped that some of the results may be of general interest and utility.

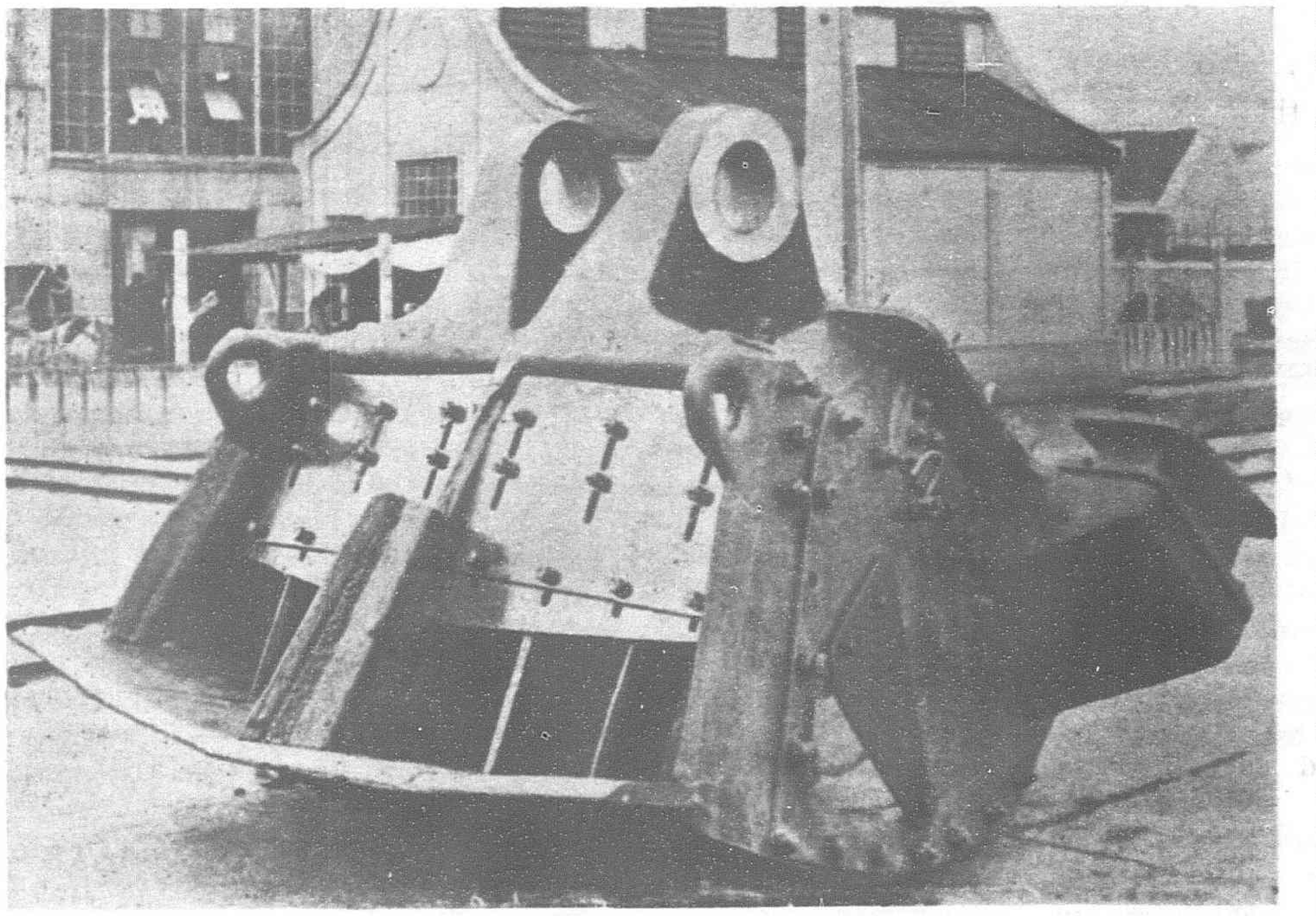


Fig. 1.—Standard draghead with shutters

The original Frühling patent[¶] indicates the basic principle of combined scooping and suction, but the inventor, rather naturally, does not seem to have appreciated all the mechanical problems involved. The success of his dredgers from 1902 onwards in handling very soft mud led to the type being widely used for work on ocean bars, and there are now about seventy such vessels in existence. It was found, however, that the output was disappointing whenever sandy material was met with, or when the mud to be excavated was very stiff. Herr Otto Frühling and his imitators made various efforts to overcome this difficulty, but to this day the thickness of the pumped mixture obtained by this type of dredger in sand is often not very much better than that obtainable with the ordinary moored-suction dredger. In the case of fine sand which does not settle quickly, a thin mixture is particularly objectionable in hopper-dredgers, since it involves the useless transport in the hopper of a large volume of water or, alternatively, the flowing overboard of the thinner spoil in the hope of retaining a fair load of coarser particles. Much of the materials sent overboard actually resettles in the cut, even when there is a strong transverse current. On the other hand, with this type of dredger working in smooth, soft mud, it can happen that the material comes up almost free of added water.

The case of the Yangtze Bar mudwas peculiar, inasmuch as the typical bar-material was smooth and soft, but of unusually high density (1.6 to 1.9), in spite of the mineral being of the usual silica and alumino-silicate make-up. In the actual fact, this material proved extraordinarily amenable to drag-suction, being brought to the surface with a density at times as high as 1.6. Whole hopper loads with a density of this value have been obtained; those with 1.5 are frequent, and average hopper densities of less than 1.4 are considered bad. Assuming the in situ material density to be 1.8, a density of 1.6 corresponds to a mixture in the hopper containing 75 per cent of in situ material, 1.5 corresponds to 62.5 per cent and 1.4 corresponds to 50 per cent, proportions quite unobtainable with moored suction-dredgers.

In the middle of the bar, however, a patch of sand with a density of about 2.0 was found, and it was at first quite difficult to dredge mixtures with a density exceeding 1.15 corresponding to 15 per cent of in situ material. Fortunately, this sand area was limited, and its margin consisted of loam which pumped more easily. It was later found that by partially closing the mouth of the draghead, a richer mixture up to a density of approximately 1.25 could be obtained, but the additional resistance to cutting remained a difficulty[**]. Intermediate materials gave better results.

Relation of Output to Draghead Dimensions and Vessel Speed

With one of the dragheads in use, there is an entrance area of about 20 sq. ft., and the speed over the bottom during dredging may be as much as three knots (say 5 ft. per second). The ideal output in this case would be 100 cu. ft. per second if the head were completely buried in the mud. The dredger being designed to take 2,500 cu. yds. per trip, this would mean that the hopper might be filled in $(27 \times 2{,}500) \div 100 = 675$ seconds or 11.25 minutes.

Such a good result as this was not actually obtained, but occasionally hoppers were actually filled with 4,000 tons of mixture in 15 minutes, consisting of about 2,500 cu. yds. (3,375 tons) of in situ mud and 625 tons of water (833 cu. yds.), that is 33 per cent by volume of water added, corresponding to a mixture density of 1.6 if the in situ density was 1.8, or 1.525 if the in situ density was 1.7.

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[*] Reproduced by permission from the *Journal of the Institution of Civil Engineers.*

[†] *Selected Engineering Paper No. 125*, Inst. C.E. 1932.

[‡] For description see *The Dock and Harbor Authority*, August and September, 1937.

[§] For description see *Engineering*, vol. CXLVI (1938), pp. 495 (October 28), 577 (November 18), and 638 (December 21).

[¶] Brit. Pat. 19239, September 9, 1938.

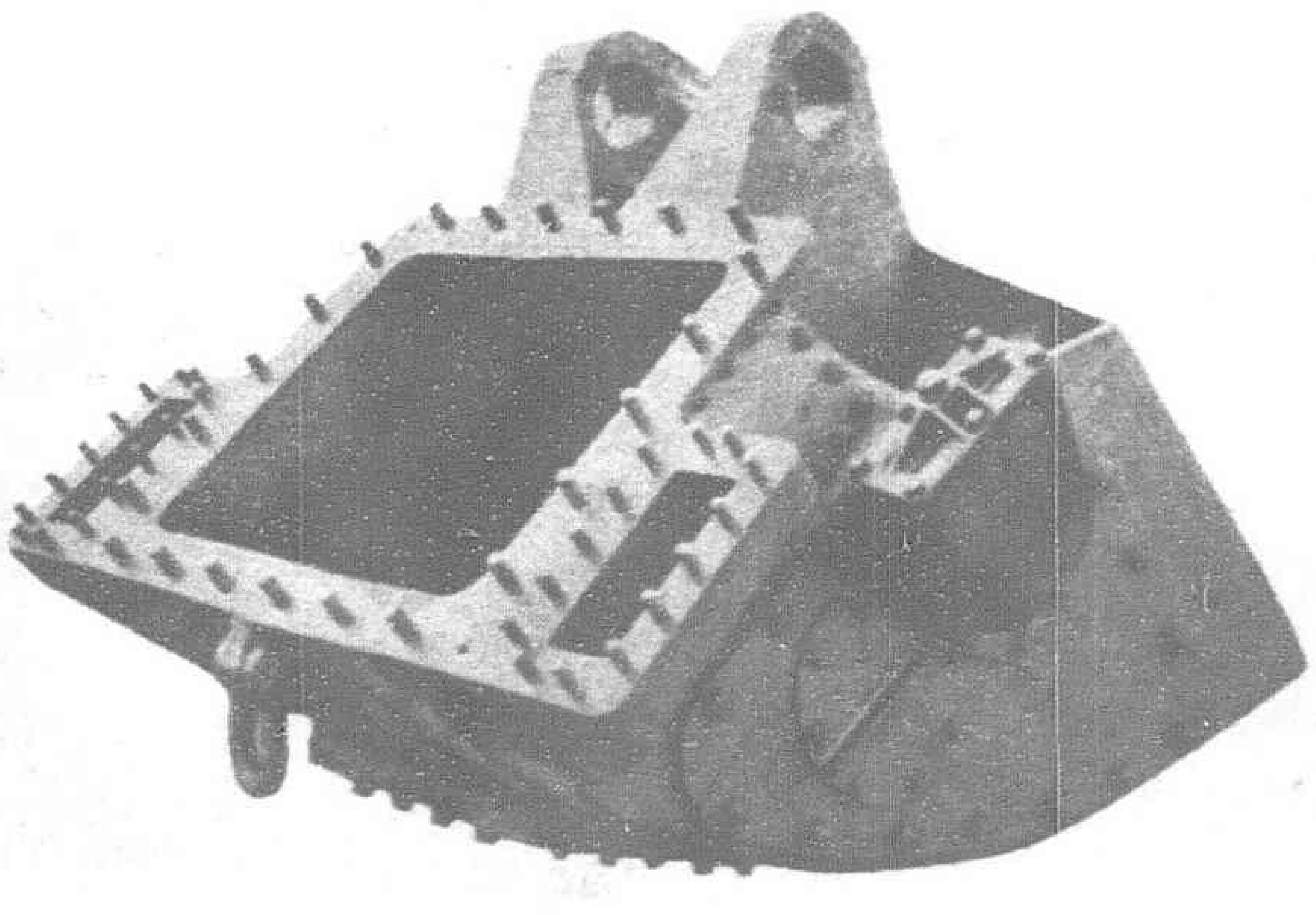
[**] *Engineers in the United States of America* use a flat shoe-shaped head with a grid that scrapes up the sand. This head lies behind the pipe, thus avoiding the bend, but losing the plough effect.

If all the added water is obtained by suction (pressure water could be supplied, but was not always found necessary), this means that in the average, the draghead was 25 per cent (11.25 minutes divided by 15 minutes is 75 per cent) open at the top, and the average inflow-speed of the water was about the same as that of the mud since the mixture consisted of about 25 cu. ft. per second of water and 75 cu. ft. per second of mud. Actually, the water-inflow must fluctuate according to the effective suction at the mouth of the draghead and the breaking up of the mud in the lower part of the pipe.

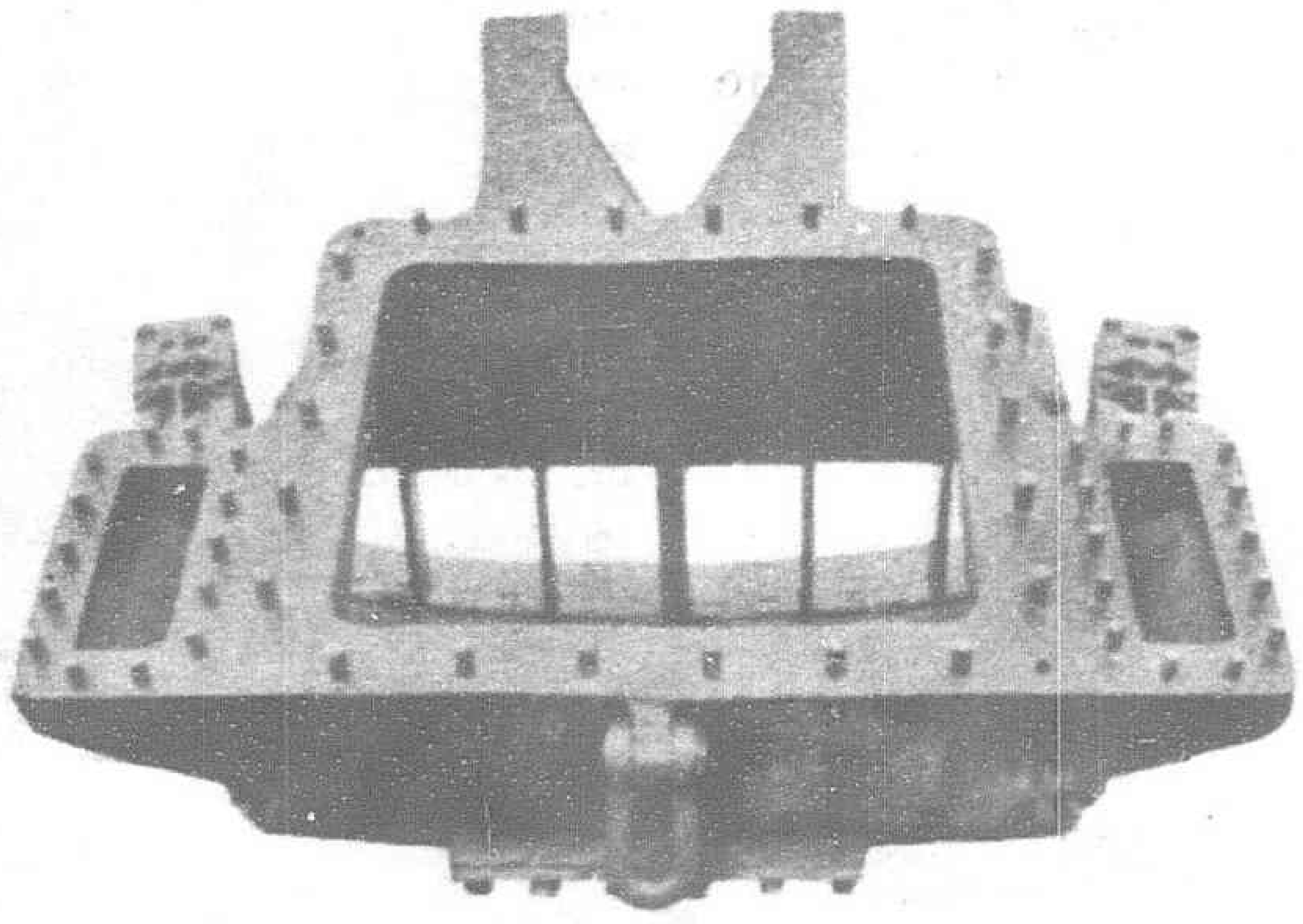
This roughly represents the most favorable conditions.

Turning now to the case of sand, the higher resistance of the sand to cutting has two results. Firstly, the draghead does not penetrate so deeply into the bottom, leaving a far larger opening for the water to enter the head. Secondly, the speed of the ship over the bottom will be reduced. Thus if the buried sectional area is reduced to, say, 8 sq. ft. and the speed is reduced to 1.5 knots (2.5-ft. per second), the output cannot exceed 20 cu. ft. per second. The inflow-speed of the water will be higher than that of the sand, owing to the large opening (12 sq. ft.) and the strong vacuum, and may easily amount to 10-ft. per second, making an influx of water of 120 cu. ft. per second, and causing the mixture to have a density of 1.14. This is precisely the sort of result that is obtained in sand if the same head is used as for mud.

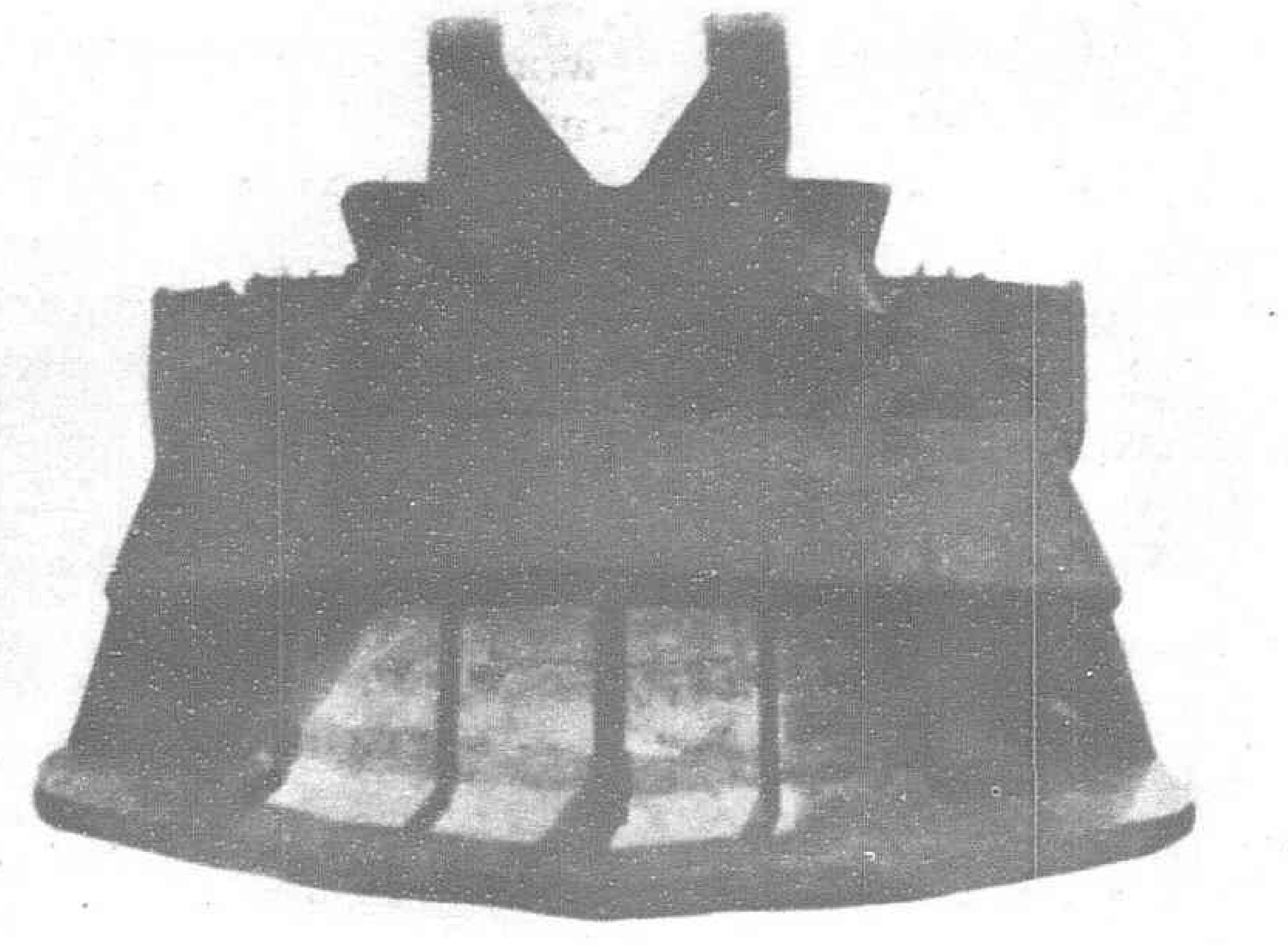
It is obvious that if more thrust is available the head can be buried deeper, but, unless the dredger is designed with a surplus of thrust, this is not feasible. In actual fact, with a given dredger there is only one method of dealing with the situation, and that is to use a smaller draghead, or partially close the opening with adjustable shutters (Fig. 1). Both devices are quite successful and can increase the density of the sand mixture to 1.25, or even 1.3. The actual rate of dredging is not thereby perceptibly increased, but the denser mixture gives a better hopper-load, involving less wasteful transport of dilution water and so increasing the total daily output. The author believes that with optimum thrust and area combination a sand mixture containing nearly 50 per cent of original material (by volume) could be obtained, since mixtures of this kind can be pumped under pressure.



TOP VIEW



THREE-QUARTER TOP VIEW



FRONT VIEW

Fig 2.—Experimental draghead

Resistance to Cutting

It is clearly necessary that there shall be a reserve of propeller-thrust over and above that required to move the ship through the water at the relative speed (in the case of strong tidal currents this means full current speed, plus speed over the bottom) sufficient to force the draghead into and through the bottom. Actual towing tests are the best means of measuring the thrust required, but an approximate idea can be gained by multiplying the buried periphery of the draghead by three times the buried depth into a shearing force appropriate to the material. Thus with a head 8-ft. wide, buried 2-ft. deep in mud, having a shearing resistance of 300 lbs. per sq. ft., the total resistance is about :

$$(8 + 2 + 2)\ (3 \times 2) \times 300 = 21{,}600 \text{ lb., or say 10 tons.}$$

With a speed over the bottom of three knots (5-ft. per second) this amounts to

$$\frac{21{,}600 \times 5}{550} = \text{nearly 200 horse-power}$$

In sand, if the same head is only buried 1-ft. and the shearing resistance is 700 lb. per sq. ft., the total resistance is

$$(8 + 1 + 1)\ (3 \times 1) \times 700 = 21{,}000 \text{ lb.}$$

This example indicates very clearly how greater resistance reduces the penetration and, in the absence of shutters, increases the water opening.

Resistances in Suction Pipe

The vacuum at the eye of the pump has to overcome :

(*a*) The head of fluid in the suction pipe less the hydrostatic head of water.

This may be quite important with thick mixtures. Thus, if the eye of the pump is just at water level (it is usually below that level, but as the impeller is vertical and nearly 9-ft. in diameter, it is difficult to put the eye very much below the light-draught water level) and the mixture has a density of 1.6, the head to be overcome, measured in feet of water, is 0.6 times the depth in feet of the bottom of the cut below water level. For the vessel in question, this depth was a maximum of 45-ft. Since $0.6 \times 45 = 27$- ft. (24.5-ins. of mercury), this would utilize almost all the vacuum, and indicates clearly that this type of dredger cannot work to great depth if it is to lift dense mixtures. In actual fact, when the hopper was full of water, the eye of the pump was some 11-ft. below water level, so that the lifting head required in this state was:

$$(0.6 \times (45 - 11) \quad - 11 = 9.4\text{-ft.}$$

At light load the eye of the pump was actually 3-ft. below water level, so that the maximum lifting head required to overcome the weight of the mud in the pipe was

$$(0.6 \times (45 - 3) \quad - 3 = 22.2\text{-ft.}$$

Obviously, this great demand on the vacuum tends to make the mixture thinner at the beginning of the pumping.

(*b*) The friction head in the pipe.

For a thick but smooth-running mixture, the fluid friction is about ten times that of clean water, but the pipe has one sharp bend in it, at the draghead, and certain changes of section, so that about 15 times is the least that should be considered, or, say, 0.075 lb. per sq. ft. at 1-ft. per second. The actual length of the suction pipe in question was about 75-ft., and the velocity (for mud mixtures) of the order of 10-ft. per second. The periphery was about 11-ft., so that the total resistance was about :

$$75 \times 11 \times 0.075 \times 10 \times 10 = 6{,}188 \text{ lb.}$$

The sectional area of the pipe being about $10\frac{1}{4}$ sq. ft., this corresponds to about 600 lb. per sq. ft. of pipe section, or 4 lb. per sq. in., equalling about 25 per cent of an atmosphere or 8-ft. of water, or 7.5-ins. of mercury.

If the mixture is very thick or the particles inclined to lock together, the coefficient of rubbing friction will increase and the flow may be checked by the lack of suction head.

(c) The kinetic head.

The main pump of the *Chien She* when taking in water alone brings up 18,000 tons per hour or five tons per second, equalling 180 cu. ft. per second. This figure may be compared with the dense mixture referred to above (2,500 cu. yds. of mud, plus 833 cu. yds. of water in 15 minutes, equals 100 cu. ft. per second). The water intake velocity for 1-in. (mercury) of vacuum at the draghead is, allowing a coefficient of contraction of, say 0.6, about 9-ft. per second, and rises as the square root of the available vacuum. Thus, even allowing for the higher densities, 2-ins. of vacuum (say 2.1-ft. of water) will provide the necessary kinetic energy.

If the mixture is thin and the mouth of the draghead is only partly buried, the vacuum in this place may rise to approximately 4-ins. of mercury, causing an intake velocity of perhaps 20-ft. per second, so accounting for the excess of water in sandy mixtures.

The dredger is provided with a high-pressure pump capable of giving as much as 6,000 gallons per minute at 30-ft. head, or 2,500 gallons at 160-ft. head. The first figure corresponds to about 16 cu. ft. per second, which is quite a large fraction of the small dilution necessary with high-density mixtures. This water is fed into the back of the draghead by nozzles flush with the interior surface and directed, as nearly as possible, in the direction of the flow of the mud, that is, backwards into the head and pipe.

Design of Suction Pipe

Having regard to the considerations of vacuum efficiency, the writer has been very surprised to note in many designs the lack of attention which is given to designing the head and suction pipe to have minimum fluid resistance. He is convinced that the pipe should be as large, short and straight as possible. Single pipes are to be preferred to double ones (which have 41 per cent more skin area for the same sectional area), the pipe should run direct into the eye of the pump and the knuckle-joint, which is required to allow the pipe to be lowered, should be arranged so that the bend is as easy as possible in the average working position. At the junction with the draghead, the curve, which (including the back of the head) is necessarily nearly 180 degrees, should be of as large a radius as practical, and the inside should be streamlined. It is doubtless preferable that the pipe should be circular in section rather than rectangular, but the great diameter (plus the width of the ladder frame which supports the pipe) affects the width of the well and indirectly the beam of the ship, so that a rectangular section with rounded internal corners is not so very objectionable. Nevertheless, it is a fact that the perimeter for the same cross-sectional area is about 12 per cent greater for a square section than for a circular one (the ratio is still larger for rectangular sections) and the friction is increased in this ratio, and there is further added hydraulic resistance at the fairing into the pump-eye, so that a circular pipe is definitely preferable. No pockets, lap-joints, projecting bolt or rivet-heads should interrupt the smoothness of the suction pipe. In particular, the inside of the draghead should be streamlined (not merely "faired off" but adapted to fluid flow without reverse eddies) so that there will be no check of any kind to the motion of the mixture. The early Frühling heads were rather defective in this respect, especially the very broad ones.

An external envelope for the pipe-ladder to reduce the fluid resistance to propulsion and currents is advantageous.

An interesting feature of this particular dredger is that the pressure-water pipe has been made a link which holds the head at a constant attitude by means of a fork, so that the cutting angle is not affected by the depth of the cut. The angle can be changed if desired by wedge-shaped packing pieces. Angular control-gear was considered, but it was decided that its unknown advantages were outweighed by the loss of rigidity and the probable difficulty of maintaining a relatively delicate under-water device.

Figs. 2 show an experimental head which has been built, with removable upper plug-lip, suction-release spring-controlled side valves and extra access-doors for possible future interior jets to be operated either by the suction or from the pressure-water line. The writer believes that in some instances such jets might be useful if externally streamlined and directed in the direction of the mud flow. Frühling contemplated various devices, such as rotary cutters inside the drag-bucket, but the writer is convinced that such apparatus, by obstructing the mud flow, would nullify any advantages it might otherwise possess, and that the head should be kept clear only by smoothness, stream-form and jets parallel to and in the same sense as the flow.

Pumping Plant

The main pumping engine is a triple-expansion steam engine of 2,400 indicated horse-power at 150 revolutions per minute, the suction pipe is equivalent to a 43.275-in. diameter section, and the discharge pipes leading over the hoppers are each 27.625-ins. in diameter. The hoppers can be pumped out by two suction pipes of same size as the discharge pipes. Overboard discharges of 39.375-in. diameter are provided for emergency and shore pumping. The impeller of the main pump is four-bladed and 8.5-ft. diameter over the tips. The water delivery is 18,000 tons per hour at 120 revolutions per minute.

Full particulars of the vessel are contained in the writer's published report to the Conservancy Board*, which has been published, slightly abridged, in London†.

Discharging

The vessel is ordinarily discharged through ten pairs of wooden doors, the opening at each pair being 81-in. by 88-in. In the case of mud, the efflux is very easy, and the whole hopper can be emptied in less than two minutes, but with sand the whole clearance may take four minutes. The vessel is provided with five sea intakes on each side, controlled hydraulically from the bridge. These are intended to provide dilution water when pumping out the hopper, but in actual fact the mud can be discharged through them with comparative ease. In view of this fact, it was decided to put cylindrical valves in the second dredger so as to reduce the cost and inconvenience of door maintenance, and also avoid the risk of striking an open door against the sea bed. The doors on the whole have proved satisfactory, but there is considerable wear at any point where a leak develops, due to the erosive action of the sand on the timber. On one occasion the hydraulic ram controlling the door chains on one side failed to act, causing a dangerous list, and on another occasion the chain supporting a pair of doors broke above the balancing bridle and the bridle fell through.

When not dumping the main door chains are locked with heavy steel cotters, and the labor required to knock these cotters in and out is worth saving.

The objection to the cylindrical valves is that they occupy a considerable volume in the hoppers, and if the material is stiff it may jam between the sides of the hopper and the cylindrical wall of the valve. They have functioned quite well for many years working on the "Leviathan" in the Mersey when handling sand, and are reported from several ports to be quite satisfactory for use in mud dredging.

For discharge by pumping, hand-gear to control the exhausts to the suction pipe-lines have been provided, and also hand-gear for the sprinkler controls by which high-pressure water can be admitted to the hoppers just above the doors. This gear has worked satisfactorily, but in fact the hoppers are rarely pumped out, so that its trials have not been exhaustive. It would naturally be preferable that all these valves should be hydraulically controlled, and only the cost and complexity of the extra hydraulic pressure-lines and control gear on the bridge has caused hydraulic control to be omitted in this case. Labor in China is comparatively cheap, and when pumping out there is no such urgency as when dredging so that the valves can be opened in succession.

Computation of Discharge

It is of the highest importance that the actual output of the dredger should be rather accurately determined and in any case not be over-stated. Seeing that the hopper load always contains

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*The Dredger *Chien She*. Whangpoo Conservancy Board, Shanghai, 1936.

†*The Dock and Harbor Authority*. Vol. 16, 1936-37, pp. 278 *et seq.*, and 308 *et seq.*

some added water (unless it is first pumped dry and the mud is sucked in with a completely buried head and no pressure water is used) the problem is as follows:

Given the change of displacement during loading from the change of draught and the volume of mixture in the hopper from the level of its surface, to find the volume of in situ material in the hopper-load.

The change of displacement shows the weight of the added load in tons, and the calibration of the hopper gives the volume of the mixture. If the latter is taken in cubic meters, the ratio of the added weight in tons to the hopper volume gives, with sufficient accuracy, the density. If the "in situ" density is assumed (on the basis of previous observations), the fraction of the original material in the load can be simply computed or read off on a graph.

During the official contract trials actual measurements of the in situ density were obtained by "dry" scrapings made with the draghead. These were dug out of the lifted head, placed in cylindrical measuring vessels, and pressed into place by hand until the vessels were full and then weighed. As in actual fact such scrapings contained interstices and could not be brought back to the original consistency, these densities tended to be a little on the low side, but not much. The figure of 1.8 was often obtained for such mud, but occasionally lower figures occurred.

On the trials the actual densities so obtained were used in computation so that the contractors should not be penalized, but in practice the 1.8 reference density is usually employed, unless the material appears different.

The initial water in the closed hopper mixes with the load, but if the latter is dense the initial water tends to be pushed over the weirs when the hopper is nearly full, and does not greatly dilute the mixture. It is, however, an additional disadvantage when pumping fine sand, but not usually sufficient to warrant the loss of time involved in pumping the hopper dry. Draught indicators are fitted, but are only used to control actual readings in the pipe well, fore and aft. When dealing with material which will pump well the load-level is regulated by a weir at a suitably low level, as a completely full hopper with such material gives too great a draught. With thinner mixtures the hopper can be filled to the coaming and run over same, but it should be aimed at and not simply full hoppers which may consist largely of water.

The displacement of 19-ft. draught is about 9,000 tons (adjusted from time to time for consumption of coal and water), but would be only 7,400 tons if the doors were open.

The displacement at 11-ft. draught is about 5,000 tons, but is only 4,300 tons if the doors are open. In other words, the hopper contains 700 tons of water or 700 cubic meters if the hopper is not pumped out.

The hopper capacity to the deck level (3-ft. below the coamings) is 2,900 cubic meters, so that at the moment of filling, if the water has not been pumped out, there is only 2,200 cubic meters available. If the mixture has a density of 1.5, this means that 3,300 tons can be put in, but in actual fact the full 2,900 cubic meters of mixture can be pumped adding 2,900 × 1.5=4,350 less the 700 tons of initial water pushed overboard, leaving an additional load of 3,650 tons.

If the density were 1.6, 3,540 tons could be put into the 2,200 cubic meters of space, or 4,640 tons if the water were pushed out, increasing the displacement, by 4,640 − 700 × 3,960 tons, or say 4,000 tons, which is the load for which the ship is designed.

A clearer idea of the effect of the hopper loading on the displacement may be obtained by considering the following routines:

1.—(*a*) Draught 11-ft. Doors open. The displacement is 4,300 tons, equalling the weight of the ship.

(*b*) Draught 11-ft. Doors closed. The weight of the ship is still 4,300 tons, but 700 tons of water is trapped in the bottom of the hoppers, and the rated displacement is now 5,000 tons.

(*c*) Water pumped out of hoppers. The ship rises until the draught is about 9.5-ft., and the displacement is again 4,300 tons, but the whole space in the hoppers is now available to produce buoyancy.

(*d*) 4,000 tons of mixture pumped in. The total displacement is now 8,300 tons and the draught is nearly 18-ft. The level of the fluid in the hopper depends on the density of the mixture.

2.—(*a*) and (*b*) as in 1.

(*c*) Hopper filled to coaming (3,240 cubic meters, less 700 cubic meters of water already in the hopper equals 2,540 cubic meters of mixture). If the mixture poured in has a density of 1.5, the weight added is 3,810 tons, and the total content of the hopper is 4,510 tons. The total displacement (doors necessarily closed) is 8,810 tons, the draught being about 18.5-ft. The mixture, including the original water in the hopper, has a mean density of 4,510 divided by 3,240 or .38.

3.—(*a*) and (*b*) as in 1.

(*c*) Hopper filled to coaming with pumped mixture, the original water being pushed overboard. If the density of inrun is again 1.5, this means an addition of 4,860 tons to the light weight of the ship, so that the total displacement is 4,860, plus 4,300, equals 9,160 tons, the draught then being about 19.2-ft.

Unless the hopper is pumped out there is always an ambiguity due to the lack of knowledge concerning the movement of the original water in the hopper. In addition to this, the first part of the pump discharge is usually thin, and in actual fact the usual procedure is to run the pump until the hopper is full to the weir or coaming level (according to the type of material being pumped) and continue pumping until the draught reaches the safe maximum (For this particular vessel, owing to the shallowness of the dumping areas, the draught was intended not to exceed 18-ft., but when tides permitted somewhat greater draughts were used).

It is then assumed that the initial water and the starting flow have all been pushed overboard at the weir or coaming so that the additional weight is the difference between the "light" draught displacement with doors closed (that is, the weight of the actual ship) and the loaded draught displacement. Provided that the pump is run until the draught is a maximum, the error in this assumption is not serious.

To illustrate this point, it should be observed that if the hopper is just filled with clean water up to the coaming it only contains 3,240 tons, the total displacement (doors closed) is only 7,540 tons, and the draught is only about 16-ft. Every additional foot of draught (doors closed) represents 500 tons, so that an 18-ft. draught requires another 1,000 tons to be added. If, in imagination, 1,667 tons of solid mineral (density 2.5) were to be added (volume 667 cubic meters), its volume would push 667 cubic meters of the water overboard, occupy its space, and so provide the required additional 1,000 tons. Assuming, for simplicity in calculation, an in situ density of 1.75, then 1,667 tons of mineral corresponds to the mineral content of about 1,333 cubic meters of mud, or 2,333 tons of mud.

The mixture in this hypothetical case has a density of

$$\frac{(3{,}240 - 667) + 1{,}667}{3{,}240} = 1.31$$

It will be seen from this example that it is impossible to put the vessel down to the required draught even with a full hopper unless the pumped mixture has a certain rather high density. Conversely, if the mixture has more than this density, the hopper cannot be filled up to the coaming without exceeding the critical draught.

The writer may seem to have labored this aspect of the matter, but it is a fact that certain dredger-masters appear to think that if they get full hoppers with a moderately thick mixture they are doing as well as possible, whereas the maximum output is obtained by getting maximum draught, provided only a small percentage of extra pumping time is required.

Oblique Currents

The tidal current on the Yangtze Bar is rotary, the particles of water moving in a long ellipse, and the axis of this ellipse is inclined to the *thalweg* or valley line over the bar at an angle of about forty degrees. Consequently, at the time of full flood or ebb-tide the current, which at spring tides may rise to almost six knots, is on part of the cut strongly athwart the axis of the cut. The dredger is therefore obliged to steam obliquely towards the current so that the combined velocity will give the proper direction. Only when the tides are weak is it possible to dredge with the current, as since the cuttings peed rarely exceeds three knots, there must be margin for steering, and if there is an obliquity of current the triangle of velocities gives an impossible position.

When dredging in the stronger tides with a lateral "set," the mouth of the draghead is not square to the cut, and a loss of entry-area occurs. In addition to this, there is a much reduced reserve of thrust since the skin friction of the ship, and consequently the resistance to propulsion, are increased by the current. The vessel has a total of 3,000 indicated horse-power available in the propelling engines and can travel at about 11 knots in deep water with full hoppers; but even so, it has been considered advisable to provide a larger percentage of thrust-reserve in the new ship. The pipe ladder is pressed strongly against the side of the well by the transverse reaction, and it has been expedient to cut a hole in the side of the draghead to increase the influx of spoil.

This transverse current has been also the principal reason for adopting the center-well type of dredger, which allows the vessel to be swung easily around the point of contact (the draghead). In the older Frühling vessels stern-wells were usual, and have many advantages from the point of view of the arrangement of the machinery, but are much less suited to good steering in transverse currents.

Costs

During the two years which the vessel has been operating the unit cost of dredging per cu. yd. of in situ material dredged and dumped about two sea miles from the cut has been about $0.20 Chinese currency, which was equivalent to 3d. This includes depreciation at eight per cent compound discount on the original cost of the ship (roughly £160,000), overhead, salaries, wages, stores, repairs, and insurance. It does not include any interest or the cost of survey work.

The second vessel will cost nearly 50 per cent more, owing to increased prices and the changes in design, so that the unit cost of dredging will also be increased slightly.

The Author must admit his indebtedness in connection with the design of the dredger to Mr. William Smith, Mr. P. N. Fawcett, M.INST.C.E., and Dipl. Ing. J. Kolkmann of Messrs. Schichau. His predecessor, Lt.-Col. A. W. H. von Heidenstam, M.INST.C.E., and the late Sir Frederick Palmer, Past-President INST.C.E., first directed his attention to many of the salient problems.

Million-Dollar Electrical Export Markets—Philippine Islands

(Continued on page 298)

year. Since these batteries are a consumer goods and therefore dependent upon consumer purchasing power for volume sales, it is only natural that the 1938 recession should have engendered a corresponding reversal in consumer demand.

Electric Motors

The steady increase in motor imports during the period under review may be attributed in great part to the expanding mining enterprises, many of which were newly formed or further developed during said period. The mining industry still represents the best outlet in the Philippine for electric motors, although its rate of expansion and therefore its need for new electrical machinery has necessarily declined. As in all other electrical lines, American motors strongly dominate the market and experience only minor competition from similar British, German, and Swedish products.

Expansion of telephone facilities and considerable private and public building activity accounted for the very noteworthy gains in American exports of insulated wire and cable to the Philippine Islands. Competition in this field is also negligible and future prospects continue favorable. Although building activity slowed up somewhat with the start of the European conflict, it has once again assumed large proportions, particularly in Manila, with the return of structural material prices to normal.

Electric Household Refrigerators

Electric household refrigerators encounter a fair demand in the Philippine market, although distribution is restricted for most part to the wealthier inhabitants who reside in the larger cities where 24-hour electric service is available. Although household refrigerators represented the only item among those listed in the above table to show a decline during the prosperous year of 1937, this condition was due more to a heavy carry-over of previous years' imports than to an actual diminution of demand. Changing food-buying habits among the Filipinos are gradually tending to increase the desirability of refrigerating equipment, and the considerable sales gains made during 1938 continued well into the following year.

American incandescent lamps encounter a good deal of competition from numerous foreign makes, among which German, Japanese, Hungarian, and Dutch units are the most prominent. In spite of this strong competition, the American lamps, by virtue of their high quality and resultant comparative economy, control a major portion of the business. American lamp manufacturers may now find that the European conflict has so hindered the activities of their European competitors as to give them a virtual monopoly in this line such as American manufacturers enjoy in other electrical lines.

What Mauritius Owes to Quinine

THE island of Mauritius, in the Indian Ocean, was discovered at the beginning of the sixteenth century by the Portuguese, and after belonging successively to the Dutch, the French and the English was finally ceded to the British Crown by the Treaty of Paris in 1814.

British traders have set up a prosperous sugar industry in Mauritius which is known to-day as the Sugar Island. But lying far out from the sheltering coasts of Africa and India, the island is buffeted by ocean winds and terrible storms have repeatedly laid waste the sugar-cane plantations.

Until about the year 1860, malaria was unknown in Mauritius, but a serious epidemic broke out in 1866 and since then the island has never been free from the scourage. Formerly the inhabitants of the island, which possesses a mild and temperate climate, lived in security in the towns and coastal regions, but the prevalence of malaria has brought about a great change. All those who can afford to do so make their home in the mountains and come down to Port-Louis only for their daily business. Those who live in the lowlands frequently fall a prey to the malaria-carrying mosquitoes.

Fortunately, the healing properties of that natural remedy, quinine, are known in Mauritius and the recommendation of the Malaria Commission of the League of Nations has found its way even to these remote shores. This prescription serves as an indication for all regions subject to the fever; it reads as follows: as a preventive measure during the fever season take six grains of quinine daily and in cases of treatment a dose of 15 grains to 20 grains of quinine a day for five to seven days. On page 124 of its report, issued in 1938, this Malaria Commission stresses the fact that the harmlessness of quinine makes it a suitable drug for administration by subordinate personnel without constant medical supervision, whereas such supervision is essential in the case of synthetic products.

In Mauritius everything depends on the sugar industry; the welfare of its 400,000 inhabitants is conditioned not only by the fluctuations in the price of sugar on the world market, but also by the violence and extent of the hurricanes which sweep over the island. But in no country can there by prosperity until the debilitating effects of malaria have been fought with the aid of quinine.

Mid-Year Hong List Appears

Shanghai's most important published bound volume in its mid-year edition—the familiar carmine-backed Hong List of *The North-China Daily News*—made its appearance early in July. The latest volume has approximately the bulk of the regular annual edition, and in it is brought up to the minute all the vast array of detailed information about Shanghai and its inhabitants and about China that has made this publication famous. All the usual features that enter into a city directory, and many not found in ordinary directories, are to be found recorded in the new Hong List. It is the one volume that, to the ordinary resident of the Port, is quite indispensable.

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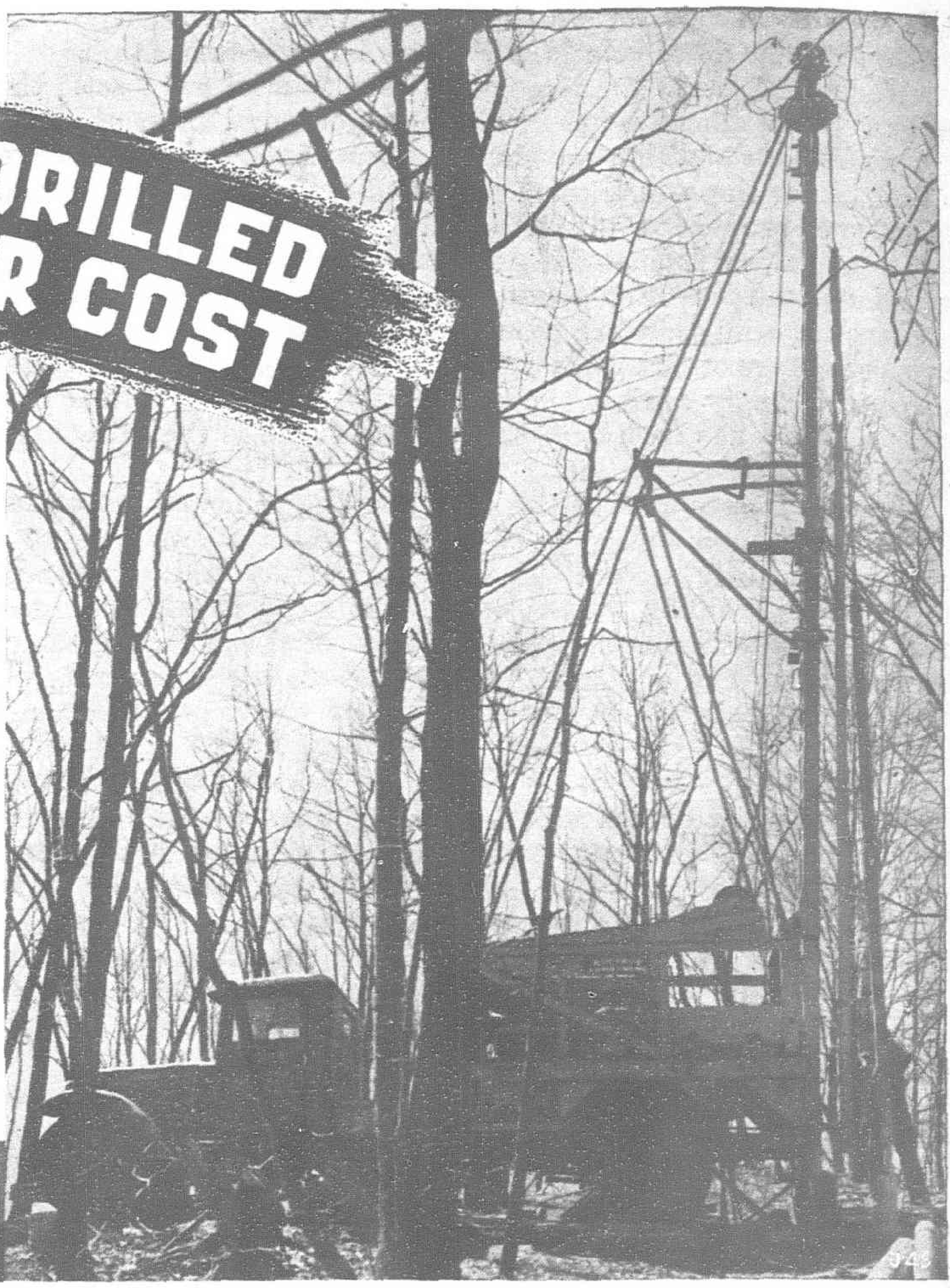

China's Communications

CHINA to develop her communications, needs an efficient and centralized organization, an increase in transportation facilities and service stations, and a determination on the part of the people to economize, according to Mr. Chang Kiang-an, Minister of Communications, in a special report released in Chungking.

The first step is materializing with the recent organization of the China Transport Corporation which will absorb all civil transport systems in China. The second one will be carried out according to the nation's financial strength, while the third demands the co-operation of every Chinese citizen, Minister Chang added.

Since the outbreak of war, more than 5,700 kilometers of highways were built in the interior of China. This figure brings the total length of China's highways—including those in the Japanese occupied areas to more than 82,000 kilometers. These figures are given by Mr. Chang. Minister Chang points out that many problems have yet to be overcome before the nation can expect to have a serviceable transportation system. In road maintenance, he said, China is spending only $8,800,000 a year for every 10,000 kilometers of highways. This amounts to a little over $70 a month for the up-keep of every kilometer. If the highways in Hunan Province—the best in China, which require more than $180 a month for the maintenance per kilometer—are to be taken as standard, $13,000,000 more has to be spent on every 10,000 kilometers of highways, or $106,000,000 more on the total length of roads in China each year. The enormous cost makes extensive road improvements in China impracticable under present conditions.

The vastness of interior China necessitates a huge fleet of trucks to carry international trade, added Mr. Chang. If the average distance from the nearest foreign territory to an inland destination is 1,200 kilometers, and if the average round trip takes 16 days, China must keep 8,000 trucks running continuously to meet her needs. A further 25 per cent of trucks in reserve will make a grand total of 10,000 vehicles necessary. If the minimum cost of a truck in China is $10,000, then the total cost of 10,000 trucks would be $100,000,000. Minister Chang estimates that if a truck in China has a useful life of 100,000 kilometers and that if the daily traveling distance averages 150 kilometers, its life-span is only 20 months.

Even more important is the consumption of gasoline, continued Minister Chang. Based on the above figures, the 8,000 trucks traveling 45 single, 1,200 kilometer trips a year would cover a total distance of 432,000,000 kilometers. If a gallon of gasoline can supply power for a 10 kilometer drive, the 432,000,000 kilometers would require 43,200,000 gallons costing $432,000,000 at a rate of $10 per gallon. In addition to this cost, Minister Chang estimated that $72,000,000 must be spent on tires for the 8,000 trucks.

Animal transportation in China has also been encouraged. International freight carried by animals was increased from 350 tons in February, 1938, to 1,200 tons in May, 1938. No increase in the tonnage was made however, after that, as the rainy season and the difficulty of getting larger numbers of animal drivers had made rapid development impossible. Minister Chang estimated that 8,000 horses, 37,000 men, 1,700 hand-carts, and 11,900 pullers are needed in order to carry 18,000 tons of goods from one city to another every year. If labor is made available, he believes that animals will have an important place in China's wartime overland transportation system.

The rapid currents and hidden rocks in most of the rivers in the interior of China have prevented water transportation from being developed on a wide scale. Gratifying results, however, have been achieved in the waterways in Kwangsi, Hunan, Hupeh and Szechuen provinces. Efforts have also been made to reduce the dangers of shipping in the inter-provincial waterways, especially along the famous Yangtze Gorges, between Chungking and Ichang. Improved junks with a maximum capacity of 80 tons each have been perfected by the Ministry of Communications. They are reported to be able to travel 30 per cent faster than the old-type junks.